THE AMERICAN

JOURNAL OF PSYCHOLOGY

Founded by G. STANLEY HALL in 1887.

VOL. XVII. APRIL, 1906. No. 2.

CRYING.

By ALVIN BORGQUIST, Research Assistant, Clark University.

TABLE OF CONTENTS.

I. INTRODUCTION. PAGE

Statement of the problem, ... 149
Sources of material, ... 150
Classification of crying states, ... 152
Crying among primitive peoples, ... 153
Influence of age, ... 155
Cumulative development of the cry, ... 159
Physical causes and symptoms, ... 160
Introspective description of crying, ... 163

II. THE CRYING ACT; ANALYSIS AND EFFECTS.

Changes in circulation, ... 169
Attitude of body, ... 169
Vocalization, ... 171
Lump in the throat, ... 174
Sob, ... 175
Tears, ... 178
Effects of crying, ... 181
Summary of Part II, ... 186

III. THEORIES AND INTERPRETATION OF DATA.

Theories, ... 188
Physiological and biological data, ... 193
Interpretation of the crying act as a whole, . . 197
Summary of the psychology of crying, ... 201
Reference, ... 202
Acknowledgments, ... 204

I. INTRODUCTION.

Statement of the problem. Crying, far more than its opposite, laughing, is a neglected problem of psychology. This peculiar complex of characteristic movement and feeling, which has

such a prominent place in the emotional life at all ages, is very rich in its suggestiveness as a psychological problem. Besides the light which an explanation of crying may throw upon a general theory of the emotions, there arise special questions in regard to its development and to the nature of the particular associations which it involves between the mental state and the physical expression.

Standing as it does at an end of the emotional scale as the expression of extreme displeasure, its sharp contrast with laughing—expressive of the higher states of pleasure—is significant, especially when the extreme psychological similarity of the two phenomena is taken into account. The question may be raised at the outset whether we are not here dealing with fundamental modes of expression which are the basis of pleasure and displeasure in their most general form. The cry, as expression, is closely related to language development—a phase of the subject in which ethnological questions cannot be avoided.

In its extreme forms, crying presents problems which, though properly coming within the province of the alienist are also psychological, and which, when solved, will be helpful in the interpretation of normal emotion. The hygienic aspect of the crying state is important both in itself and for conclusions of more general pedagogical application that may come from its discussion.

Sources of material. The data upon which the present study of crying is based consist in part of 200 returns (161 females and 39 males) from a special questionnaire sent out by President G. Stanley Hall. The questionnaire is as follows:

1. As a child did you ever cry till you almost lost consciousness or things seemed to change about you? Describe a cry with utter abandon. Did it bring a sense of utter despair? Describe as fully as you can such an experience in yourself, your subjective feelings, how it grew, what caused and increased it, its physical symptoms, and all its after effects. What is wanted is a picture of a genuine and unforced fit or crisis of pure misery.

2. Describe such a fit of crying, either of an individual case or a composite photograph of it in other children you have seen.

3. Do you now have crying spells, with inadequate cause, at certain seasons, when you give way to tears and sobbing when alone or with others? If so, describe a typical case or two. Did you feel great easement, rest, refreshment, or relief afterward, and is occasional crying a good thing and too much repression bad?

4. Describe each symptom of a "good cry" in order. (1) Are tears first and can they be repressed? Have some a weakness for lachrymose symptoms, as for blushing? Is it sometimes a mere secretion of overloaded glands, with little psychic pain, taste of tears, and is it always the same? Do tears cease early in the spell, differ in quantity, are they more in one eye than the other, is there a difference of age, sex, personality in this? (2) Describe lump in the throat and its repression, effects on respiration, on the voice, complexion and circulation.

Is there nausea? (3) Describe vocalization of the cry in old and young, individual cases. What is a sob? Describe its frequency and culmination. Is there physical pain and where; in throat, thorax, abdominal walls? Where is the seat of convulsiveness? Is sobbing the climax of the cry? (4) Where and what are the first signs of alleviation? Describe stages of recovery, symptoms of a recent cry, psychic retrospection. Are there stages or symptoms you specially like or dread?

5. Are there cry fetiches, *i. e.*, special acts, thoughts, experiences or scenes that have pre-eminent power to cause it in you? What conditions, internal and external, are most and least favorable?

6. The artificialities of crying. When and how are you impelled to cry for effect or intensifying symptoms? How far can control of crying be itself controlled by will? How does resentment modify the genuine expression of pure grief or psychalgia? Is there desire to excite pity? What are the effects of fear, or shame? Having felt the impulse to cry, can it be so entirely repressed that later, when alone, you are more impelled to vent it and yield? What symptoms can be most and what least controlled, or controlled for effect? Do you cry *to* people? Describe crying as a source of pleasure in power to control the feelings of others, to draw their sympathy, or cause them to regret their acts. Describe effects of the tears of parents, teachers and friends on our conduct.

7. Describe an angry cry, its phenomena, occasions, results. Describe effects of yielding to children's tears on them. Describe the child spoiled in this respect.

8. How are your crying habits modified by age as to frequency, cause, duration, provocation, symptoms, and reactions afterwards?

9. In what respect is crying good: in infants, children, adolescents, in maturity, and in what bad? Should it have a place and a cult?

10. Can you describe cases of crying in persons usually self controlled when the final break down comes as a cumulative effect? Does such crying tend to become hysterical? Is it followed by physical prostration? Is it a cause or an effect of physical weakness?

Returns were received from the State Normal School, New Paltz, New York; State Normal School, Westfield, Mass.; School of Ethical Culture, New York City; State Normal School, Emporia, Kansas.

This material has been extensively supplemented by ethnological data secured, for the most part, through the Bureau of American Ethnology, and its reports and from the Archives of Aboriginal Knowledge. Twenty special letters and questionnaires were also sent out, some to the Ethnologists of the Smithsonian Institution, under the direction of W. H. Holmes, Chief of the Ethnological Bureau. In correspondence with missionaries, other material was obtained relating to the inhabitants of various islands of the Pacific, the Japanese, Samoans, New Zealanders and Maoris.

A copy of a letter sent to a missionary among the Maoris will indicate the nature of the ethnological material obtained:

(1) Do the Maori cry? (2) If so, what are the elements composing the phenomenon so far as they are apparent—tears, sobs, vocalization, changes of complexion, attitudes, movements, contortions of the face,

etc., if any? (3) What are the leading occasions or provocations—fear, shame, anger, pain, grief, etc.? (4) Intensity, duration, after-effects, physical and mental; *e.g.*, does he remain depressed or soon recover and become hilarious or cheerful? (5) Difference in age or sex?

The subject as it is to be presented is divided into three parts. —Part I contains data and partial interpretation of more general aspects of the subject, the classification of crying states, crying among primitive peoples, influence of age, cumulative development, physical causes and symptoms, and description of the mental states in crying.

Part II makes an analysis of the crying act as a series of physical events, such as circulatory symptoms, attitudes of the body, vocalization, lump in the throat, sob, tears, and the physical effects.

Part III is a general résumé of the present theories of crying, physiological and biological data, development of theory, and general summary of the subject.

General Aspects of Crying.

Classification of Crying States. Whatever further analysis may show to be the common or essential elements in the crying state, a cursory survey of the emotional field, over which it extends, reveals the fact that we are dealing with a phenomenon that is widespread and probably exceedingly complex.

In answer to the question what are the special acts, thoughts, experiences or scenes, internal or external conditions that have a pre-eminent power to cause crying, 307 occasions were mentioned. These causes and situations fall into forty-seven groups.

In these groups, all the emotions that are mentioned in Ribot's classification are represented, as are also all of the occasions of emotions noted in President G. Stanley Hall's studies of fear, anger and pity, and even the depressive reactions to darkness.

Doubtless such refinement of classification of causes of crying could be extended still further. Burton in his *Anatomy of Melancholy* finds over seventy different causes of mental depression.

The range of feelings, therefore, over which the crying state extends is so great that it is an open question whether there is any limit to this act within the field of the emotions.

The returns indicate three types of crying situation sufficiently marked for preliminary classification. Besides the typical cry of grief or sadness, two other main forms stand out clearly: (I) A more or less deliberate. largely vocal, cry, best represented in the crying of anger and less perfectly by the

crying in fear and in pain: (II) The cry in joy, including such forms as cries of gratitude, of tender emotion, of feelings of admiration and for the sublime.

Between these type forms all conceivable mixtures and shades occur. In the first group, typical forms of the grief are occasioned by homesickness, remorse, bereavement and melancholy or the "blues." The following cases from the returns will serve as illustrative examples of this class:

F., 22. Grief at sale of the old homestead; "I wept for hours until too weak to care for meals or companions.—Then I dropped into a troubled sleep and for days I was ill."

F., 20. "When ten the teacher cried when reproving me, which brought on an overwhelming fit of crying on my part."

F., 22, "blues." "Often when I am alone I feel, all of a sudden, as if I were alone in the world. Such an awful sense of homesickness comes over me at such times that I usually cry until the fountain of tears seems to dry up."

F.— Grief at death of brother. Long spells of crying; "felt utterly forsaken and alone, and desired to have no one near me."

These will serve to show the grief types, and the characteristic phraseology and tone of the replies.

The following illustrate the more sthenic cry, typical of pain, anger and fear.

F. Child with toothache. Tears were profuse; screamed, violent motion, loss of self control.

Anger: F., 19. "The cry did not make me feel better, only more angry."

M., 22. "When six or seven punished unjustly; howled, pulled my hair, wished to die to punish my parents."

Joy and Pleasure: F., 20. Returning home after two years; cried from joy. The spell of crying was of short duration and was not depressing in its effects.

F.,— An unexpected pleasure trip caused the tears to flow.

F., Æsthetic emotion. The sea seen for the first time brought tears.

Though the above described classes seem typical, there are many intermediate forms. It will be necessary to examine more minutely the crying state with reference to discovering whether if complex situations are analyzed and allowance made for accidental causes, such as the spreading of nervous energy, all the crying states may not be found to contain a common element, or at least may not be reduced to a few fundamental situations.

Crying among Primitive Peoples. Weeping appears to be a universal characteristic. Even the Indian brave, who according to popular tradition never weeps, sheds tears freely on occasion of the loss of a member of his family. His stoical attitude is limited to physical pain and his relation to his enemy.

Grinnel says:

"Indians at home and when acting naturally, freely express their emotions. They laugh and chatter and make jokes and cry, shedding

actual tears, sometimes with the appearance of great grief, anger or self pity: sometimes with no apparent reason. . . . Mourning for the dead is usually accompanied by the shedding of tears."

Mr. James Mooney writes:

"Indian children cry as long and loud as other children on occasion. They probably do not cry as often, as they are under less restraint both as to discipline and clothing.

"The Indian man seldom cries except under stress of great emotion or on certain ceremonial mourning occasions, but I have frequently seen unrestrained weeping of men on occasion of the death of a child—in one case a perfect outburst of uncontrollable grief of an old man on his daughter's death; and I have several times seen a man weep while embracing a long absent friend after meeting; also I have twice seen a father break down while pleading for a son in trouble. A very slight reminder of bereavement by death often starts a woman to weeping aloud, lamenting long after the actual loss. I have known this to happen from the sight of a picture, the hearing of a favorite song of the dead person, or the meeting of a close friend of the lost one. All this is spontaneous.

"There is also the regular death wail, which is more or less ceremonial, except to the nearest relatives, and which occurs immediately after a death, and at intervals for a long period thereafter. With the Kiowas and other Plains tribes every near neighbor, man or woman, tries to join in the first funeral lament, even to the extent of forced tears. The regular death wail is a long-drawn heart-breaking cry, repeated over and over with a loud voice, gradually sinking into silence, the wildest and most pitiful cry imaginable.

"I believe the Indian in general is less excitable than the civilized white man or less impressionable, but gives way readily to grief of bereavement. I have even known a father to starve himself upon his child's grave. My observations relate chiefly to the Plains and the Cherokees."

The historical and legendary accounts of crying are very numerous. The following are examples: "Tears of the mother god figure in the folk lore of many lands. The vervian or verbena was known as the tears of Isis as well as the tears of Juno—a name given also to an East Indian grass (*cox lacrima*)." (4a, p. 119).

"Oriental legend relates that, in his utter loneliness after the expulsion from Paradise, Adam shed such an abundance of tears that all beasts and birds satisfied their thirst therewith." (4a, p. 120). In the Iliad we read of Achilles "To the shore of the old sea he betook himself alone and cast forth upon the purple sea his wet eyes." (Bk. I: 352.) Andromache wept forth her affection. (Bk. VI: 440.) Numerous references to weeping are given in the Bible. "Jesus wept" at the grave of Lazarus. (John 11: 35.) King David wept over the death of Absalom and lamented. "O, my son, would I had died for thee." (II Sam. 18: 33.) "Abraham came to mourn for Sara and to weep for her" at her death. (Gen. 23: 2.) As Naomi urged her daughter-in-law to return home to Moab while she continued to Canaan, "they lifted up their voice and wept." (Ruth 1: 9.)

Crying caused by anger seems also to be widespread among primitive peoples. Historical references to it are frequent. Among the Samoans, the causes of crying that are mentioned are grief, pain, anger and fear. "The Samoan woman cries principally from anger." A reference to the Maoris says, "I have heard women cry when their husbands have beaten them and when they have quarrelled very excitedly." Of the Haida and the Tlinget brave J. R. Swanton writes:

"When a man has suffered a loss through purely natural agencies or through agencies that he supposes to be supernatural, he often seems to be thrown into utter confusion and gives way to the most childish fit of weeping. Not infrequently, however, he will follow this up with an act of vengeance against the animal or object . . . which he believes to contain an anthropomorphic being which has been injuring him."

Weeping for joy and because of gratitude, admiration, and the tender emotion seems to be mentioned quite as frequently in literature as the cry from grief or anger. "In the Kalevala we read how after the wonderful harping of Wainanpinen, the great Finnish hero, which enchanted beasts, birds and even fishes was over, the musician shed tears of gratitude and these trickling down his body and through his many garments were transmuted into pearls of the sea." (4a, p. 119.) Upon meeting Benjamin, Joseph said "God be gracious unto thee, my son, and he sought where to weep." (Genesis 43: 29-31.) Crying for joy seems to be very common among the negroes. Dr. W. E. B. DuBois writes: "In the religious meetings it takes the place of the old-time shouting." "The Maori woman cries upon meeting her friend." The Sandwich Islanders "cry when they meet their friends as well as when they part."

Some scattered references to racial differences in weeping indicate that the racial variations are partly due to custom and, in part, to other causes: but upon this point there is not enough evidence to show anything conclusively. Among civilized races there are wide differences. Darwin says that the English shed tears much less freely than the people on the continent. Teachers who have Italian children in their classes report that they cry easily; similarly, Mr. Wesley R. Long speaks from a wide acquaintance with the literature of the Latin races, of the abundant references there to weeping and tears.

Influence of age. In 108 of the 126 answers relating to the frequency of the cry in old and young, it is said to diminish with age. The following excerpts and epitomes from the returns will illustrate this point.

Adult. "Have not cried for a long time, eight or ten years."
F., 18. "Have seldom cried since I was thirteen, except when I was sick or nervous."

F., 19. Seldom since six years old.
F., 27. Has crying spells no longer.

Among the eighteen possible exceptions to this statement in regard to the decrease of crying with age, seven refer to the period of adolescence.

F., 21. A chronic crier, but crying was more frequent between twelve and fourteen.
F., 26. Cried most at about thirteen, when growing fast and was very nervous.
F., 18. The worst crying fit was at fifteen. "I seldom cry now, but did two years ago."

Five remark that crying is most frequent at the extremes of life. There are some exceptional cases, for example, a lady, who cries less now, at thirty years, than at twenty-six, but more than earlier in life, though the crying now is less violent. Another at twenty-eight says that crying increases as she grows older, but that the spells do not last so long. All of the returns indicate that crying diminishes with age, with no specially marked rhythms except possibly at adolescence, when there is an increased tendency to crying. A closer investigation of these points might bring out finer and more significant age differences. Differences in the character of the cry with age is probably of more importance.

There is much evidence pointing to significant differences in the character and the causes of the cry as age advances. The motives of sympathy, remorse, bereavement, and pity are apparently largely absent in the young child, but increasingly frequent in later life.

The causes of the earlier cries are largely ego-centric, and sensuous in nature. "The child often cries from pain, and for sympathy;" in maturity the leading motives are grief and trouble, and the infant cries because of bodily need and especially from anger—which is essentially the child cry." "The anger cry comes earlier, than the grief cry." Fear is a leading motive in the child cry. "The cry of the infant or child is largely for the purpose of obtaining something." "The cry of the adult is a cry of grief or of sympathy." These conclusions are repeated in many returns, and expressed in various ways, but leading unmistakably to the conviction that there is a radical change in the character of the cry as age advances. Only eight of the anger cries out of a total of 122 are experiences of adults or adolescents. The cries from fear all belong to the period of childhood, and it is everywhere understood that the cry from pain is tabooed in savagery and civilization alike. The monographs on child study are also in agreement with our returns, while Perez specifically notes that "sympathy is a later development," and cites examples of children in whom it is wanting at four and five years of age (32, p. 79).

Some special evidence bearing upon the age development in regard to the injured social feelings as a cry motive is offered by the work of Lillian A. Russling (unpublished manuscript, on which there is a note in the *Ped. Sem.*, Dec., 1905, 12 : 525), on the attitude, between eight and thirteen years, towards clothing. She shows that the majority of cases, in instances of loss or mutilation of clothing, are expresions of sorrow rather than of anger; that shame is the most prominent element in the complex state of depression here represented and that it increases distinctly with age.

Many reasons are assigned for the decreasing frequency and changed character of the cry with age, a state of affairs that possibly needs more explanation than appears on the surface. The following points seem to stand out. The feelings and desires which have been baffled change or vanish. As age increases the discovery is made that the new desires cannot attain their satisfaction by the early method. Society disapproves of the cry; the desire for approval leads to the abandonment of crying, which as a method of obtaining results comes to be ineffective and is, at the same time, a confession of impotency not in keeping with growing self-respect as the following excerpts indicate.

M., 25. "I realized as I became older that crying was useless."
—"The older I become the less I cry or care to. No doubt this is due to the recognition of the foolishness of crying. You begin to realize that the world cannot be obtained by crying."

Twenty-three replies have to do with the effect of shame in limiting the cry. Shame at being seen crying comes in to arrest its course and to fortify the effort at self-control. Seclusion is more often sought, while distinctions begin to be formed between shameful and legitimate cries; physical pain must be born without crying, while the sympathetic expression of grief is undiminished. One says "I cry less because I am accustomed to disappointment." The discipline of society brings about an increased power of control. The cry advances from the instinctive form to the form of social control that characterizes all emotional development. Thirty-two speak of the raised threshold of crying as age advances; remarking that the cause must be "more serious," "more adequate," "more real." Six state that in their own cases the result is an achievement not of lessened desire or feeling, but due to increased power of control and mastery over the life of feeling. The development of verbal language as an alternative method of expression helps also to diminish the cry. The generic form of demand or complaint that is expressed in the cry breaks up into special expression, linguistic and other. A growing acquaintance with the order in the world sets a limit to desire and expecta-

tion ; there is power to forecast the remoter significance of the situation ; the intelligence comes in to devise means of attaining ends.

Among the Indians it appears that the cry from pain is inhibited at an earlier period than among civilized peoples. We are told that in crying "an Indian boy is not unlike a white child, except that as a rule the Indian boy does not cry for pain, being ashamed to show that he is hurt."

The influence of age is seen also in the great frequency of the causeless cry at adolescence. The adolescent often cries for insignificant causes, or for no cause at all. Some imagined slight or even an imagined situation is quite sufficient to induce crying. The condition of luxury of grief or adolescent melancholy which usually contains a large element of pleasure, is frequently mentioned.

Twenty-seven say that the duration of the crying spell is shortened as age increases. Eleven have had the opposite experience. One observes no change with age, and another places the shortest cries at both extremes of life.

A woman of twenty-five says—"I cry less frequently than when young from similar causes ; require more provocation and recover more rapidly."

On the other hand, a girl of eighteen writes—"With years the crying spells become harder and longer ; in childhood tears were provoked at slight occasions but seldom lasted long. The child cry is in the nature of sunshiny showers."

By way of summary of the evidence in regard to the effect of age upon crying, it can be said that both the quantity and the quality of the cry change with age. The causes and conditions of its onset are different and it bears a different relation to the instinctive life as time goes on.

The early cry is predominantly one of pain, fear, anger, and hunger. Add to this the demand for sympathy and the list of causes is practically exhausted.

The question that arises with an attempt to compress the complex facts of age effect upon the cry into the limits of a simple, interpretation is whether in the development of the crying consciousness we are dealing merely with the moulding of a simple native reaction under the influence of social selection and adaptation, or, whether the complexity of the changes in the crying habit is due to the fact that there is more than a single cry motive ; whether, in a word, the expansive cry of the infant, sensuous in character, with its ego-centric foundation, and objective reference—its essentially linguistic nature—is the same in its origin, considered physiologically, biologically, and psychologically as the characteristic cry of the adult, sympathetic in character, seclusive, objectively caused and profoundly depressive and passive.

Only by a closer examination of both the mental state before and during the cry, and the nature of the physiological conditions which favor it can we hope to get any light upon this point.

The cumulative development of the cry. One of the most characteristic traits of the cry is its appearance as a crisis, the result of an accumulation of tension continued over a longer or shorter period. This development of feeling may go on after the actual crying has begun, or, on the other hand, the beginning of the cry may be the feeling crisis.

The following are illustrative:

M., 16. Must go to school; managed to keep the tears back until school was called; reflects upon the good time he might have had. "It seemed that tears long pent up now burst forth like water down a valley after a heavy rain."

F., 18. Case of personal injury, or slight; "Sad, dejected feeling that increased until I had to run away and cry."

F., 19. "When I began I knew just what I was crying about, but the more I cried the more I wanted to cry, until at last I forgot the original cause."

F., 19. "When a cry is restrained for a long time, I have noticed that in itself it is harder and more prolonged."

F., 22. Child—"begins rather quietly, but increases in vehemence and intensity. After he has fairly begun he never stops until he has cried to a climax."

F. "Have felt like crying but was restrained by circumstances; I waited under increased mental depression, till I came to a proper place, and then I gave way to my feelings."

F., 20. "I woke up in the morning with a load on my mind. . . . I dressed and went to breakfast. . . . After breakfast I could hold back the tears no longer, and went off by myself and gave way to my feelings. It grew in that I allowed myself to give way."

— — "The lump grew larger and larger until the first convulsive sob."

Twenty-nine out of thirty-one who answered the question as to whether the sob is the climax of the crying give an affirmative answer. Eighteen of the answers out of twenty-four in regard to the nature and effect of the breakdown in persons that are usually very self-controlled indicate clearly the severity of the crisis; hysteria, or physical exhaustion is frequently mentioned. This last mentioned fact shows a development of the feeling of which the cry is a partial expression. It voices the common observation that those who feel most are less demonstrative; and that feeling in those temperaments which do not allow it to spend itself in expression remains like a quiescent volcano.

Occasionally the development of the feeling appears to be rhythmical as is shown by the following excerpts from cases:

F. Child: "The crying stopped jerkily; she would cease crying for a moment, then begin again; then stop for a longer period; then another spell of crying, and so on until she finally stopped."

F. At first but few tears fell; then they rolled down her cheeks and her body shook with sobs. She would become quiet, but soon sob as before.

M. Self pity: feels himself a martyr: "so I cried again more violently than before. Tears came profusely but somewhat intermittently, swelling to great profusion as my mind turned to some new grievance."

F. Child: grief at loss of a pet dog. "She cried for two hours, and it was necessary to give her medicine to quiet her; it was only after frequent spells of crying and calm that her grief finally subsided.—Tears came in quick bursts and short gushes."

All the cases in which a cumulative development is described are cries of grief or sadness; no angry cries are so described; nor those from fear, and physical pain; the peculiar cries of childhood.

These facts indicate clearly that crying is a profound disturbance of the nervous system, that it breaks in upon a more even balance of the feelings and physiological processes as a crisis. Often the prodromal stage of this crisis, the period of accumulation, is very marked, as though the nervous mechanism was gathering force with difficulty for some act of extreme momentum. It is possible that by comparing the state of mind that prevails through the course of this phenomenon with the more general aspects of the physiological condition that accompanies it, together with the immediate and more remote physical and mental effects, some insight may be obtained into the nature of the body preparation, if it be such, which the crying act seems to involve.

Physical causes and symptoms. The relation of the bodily condition to crying is an important topic and there is much material, of great variety, in the papers that bears upon the point. A state of nervous tension that precedes the cry is frequently mentioned; reference is made to the surcharged condition of the nerves, the "nervous, touchy feeling, before going into a good cry." The increase of mental tension that precedes the cry is not accompanied by an increase of physical or motor excitement, but rather the reverse. There is an exhaustion of the nervous system, and a decreasing power of restraint. The actual outbreak comes in the nature of a sudden discharge, sometimes, on the feeling side, following the slowly accumulating tension from a single event or stimulus, sometimes as a result of a summation of causes, as in the following:

F., 21. When wrought up to a high nervous pitch, was reproved by her father for the first time since she was grown up; the result an hysterical crying spell.

Another says: "The final breakdown comes after the last straw is laid on; it comes with a storm."

F., 23. "I now have crying spells occasionally; repressed for a long time until some little thing done or said by a friend will appear to be

an enormous offence, and will start me crying; attempt at restraint is of no avail until I am entirely tired out."

Among the special causes that are said to have a pre-eminent power to cause the cry the word "tired" occurred more frequently than any other: (twenty times); "pain," nineteen times; "sick," sixteen; "nervous," fifteen. In the descriptions of the cries from "inadequate causes," nearly one-fourth appear to be the result of abnormal physical conditions, half of which were designated as nervous. The person was "tired," "nervous," "worn out from worry," overwork or overstudy. The person perhaps very seldom cries except when worn out. Under these conditions the most trivial circumstance will bring on the cry; sometimes the outburst occurs even when there is no strong mental antecedent. Such crying is especially likely to take on an hysterical character. This is variously expressed. One says "Often when I am tired I have cried over things that when I am well, I will laugh at. I have cried, for example, when I have lost my point in an argument. Before the tears would cease I would usually burst out with laughter at my foolishness."

In all of the expressions used to describe a physiological cause for the cry, it seems that it is nervous exhaustion rather than muscular fatigue that is always mentioned, a condition of lowered mental tone from overwork, or similar cause. In answer to the question whether physical weakness is the cause or the result of the final breakdown in people who are usually self-controlled it is quite as often spoken of as the cause as the result. "It is usually the effect of nervous weakness that causes one to lose control." Ill health is the basis of most of the exceptions to the rule that crying diminishes with years. In descriptions of the prodromal symptoms of the cry, weakness of the knees was mentioned and assigned as the reason for the tendency to take a prostrate attitude, evidently due to a physical weakness. The relations of the nervous weakness to the cry, is also shown in the accounts of temporary and permanent melancholia in medical literature. In many of the returns the sense of the difficulty of tasks, when one is fatigued, that seems to be especially provocative of the cry is emphasized; such expressions occur as "it seemed like a mountain," "the molehill had become a mountain." Other prodromal symptoms of the cry mentioned, are pain in the back, and back of the head.

Cowles in his account of neurasthenia describes as a persistent symptom a condition that appears temporarily in the preliminary stage of the cry, and more or less throughout its course, namely, a helpless state or a feeling of incapacity. The state of neurasthenia he defines as a morbid condition of the nervous

system, the underlying characteristics being weakness or inability, with languor and mental depression. The mental depression is caused by the condition of depleted nervous energy, from a sense of lack of the power to meet the conditions of life. The depression from incapacity leads to doubt and distrust of one self, anxiety and hopelessness. The anatomical basis of neurasthenia is deficient oxygenation of the central nervous system; fatigue, in its last analysis, is a deficiency of this substance in the cell. This condition is brought about by a tardy circulation and insufficient oxygenation in the lungs, or is due to sluggish circulation that fails to carry away the waste products, which consume the oxygen by entering into combination with it, at the same time poisoning the cell itself, or weakening its power to assimilate and to resist excitement.

This loss of power to resist disturbing forces means that small occasions have an unduly large effect when judged by normal standards as in the psychoses of our causeless nervous cries and our irritable people. (6 a, and b.)

Kraepelin gives a picture of a similar condition in an account of a patient with melancholia in whom there is no other symptom than a depressive and apprehensive state of mind. "The whole condition is one of permanent apprehensive depression with the same accompaniments as are found in the mental agitation of the sane, viz., a loss of sleep and appetite, and a failure of nutrition. (23.)

Richardson says of melancholy which is explained in the same physiological language, "among gestures expressing misery the most prominent and characteristic is that of weeping . . . when not fully expressed the eyes in the melancholy patient are commonly full of tears." (37.)

Certain other physical conditions clearly of a pathological kind, but not so typically nervous exhaustion, are accompanied by excessive weeping, such as some forms of acute mania, and often in hemiplegia, and in degeneration of the brain as in senile dementia. Weeping, according to Darwin, is common to insanity in general and even to the idiotic, except the cretins, even when complete fatuity is reached. (7, pp. 155-156.)

If Kraepelin is right in tracing all mental disease in which there is no mechanical lesion to nervous fatigue, and if Ribot is right in contending that pain in all its aspects, both physical and mental, is the sign of disintegration and imperfect metabolism and progressive death, then our conception of crying as a recognition of impotency is supported abundantly.

Darwin is working on this basis in showing how quickly the fatiguing effects of physical pain, fear, and the shock of sorrow are manifested. Of the last he says, "as soon as the person is fully conscious that nothing can be done, as when the mother

has lost her child, despair or deep suffering takes the place of frantic grief. The sufferer sits motionless or gently rocks to and fro, circulation becomes languid, respiration ceases. All this reacts upon the brain and prostration soon follows with collapsed muscles and dull eyes." (7, pp. 79-80.) In other words, the physical attitude tends to perpetuate the physical condition, upon which the mental state depends, and when these become fixed the mood also persists in the downward progress through insanity to death.

These facts are quite sufficient to show that in the crying state the element of exhaustion or nervous inadequacy is often very prominent. The cry in many cases supervenes at the end of a period of depleted nervous strength or lowered nervous tone. Nervous exhaustion was of every degree from the effects of some minor physical disturbance which resulted in the lessening of vigor of the physiological processes, to the clearly pathological case as it occurs in melancholia, and neurasthenia.

Introspective Description of the Crying State. The typical state of mind that accompanies the act of crying appears to be despair. This is shown by the remarkable frequency of the expression of some equivalent of a desire not to live; the feeling of being helpless, hopeless, forsaken, of having no desires, is very common. This suggests at once a relationship of the crying state to such conditions as occur in the surrender stages of religious experience.

Examples follow:

F., 18. "I felt that no one loved me, or cared for me in any way; I felt that even God himself had forsaken me."

F., 21. "I felt discouraged; what is the use of trying any more. I had but one wish, and that was thwarted. Did n't care whether I lived or died and rather preferred death."

A feeling of injustice and a corresponding resentment towards life as a whole is often expressed in the language in which these mental states are described. Persecution and self-pity come in strongly.

—— "I wanted to die. I wanted to get out of this cruel world. Hoped to get sick to make my parents feel sorry."

"Wished to be sick but not to die, for then I should not be able to see those suffer who had made me suffer."

The state of mind that accompanies the cry is extremely autosuggestive, the stream of consciousness, when it is not clogged, is likely to take the form of imaginative inference, to an almost paranoic degree. The subject imagines unfortunate situations and disasters that have little relation to reality and these in turn add to the depression, if they do not serve to distract the attention.

Seclusion is usually sought when the crying begins; this ten-

dency seems to be a more deeply seated impulse than the mere desire to escape the taunts, comments, or sympathy of friends. There is a strong realization of the desperateness of the situation for the moment, to the extent that sympathy is oppressive; the crier desires to be alone; it is apparently only in the cries of the infant and the young child that the cry is toward some one, and then the state of consciousness seems often to be a divided one, divided between the call for assistance or permission to break up the cramp of the will, and a desire to be let alone.

In a word the state of mind in crying as typified in the cry of grief is one of hopelessness; there is a cessation of the will to live; the hopelessness becomes active to the extent of filling the consciousness, sometimes to the exclusion of the cause and the situation to which the cry immediately refers, the mind goes on to dramatize death and total renunciation of effort. There is no call for help as in the child cry, but a realization of the hoplessness of help and a sense that the internal forces are inadequate to rouse the will from its paralyzed state. In all of the forms of crying there is probably an element of sadness. When a girl cries because she is "beaten in an argument," or when a man cries when he is about to go into a fight, there is presumably an element of apprehension and discouragement. The state of unmixed anger is not a tearful nor a hopeless state of mind. If we follow the angry, tearless cry of the infant to the period when the vocalization is inhibited by social disapproval, this is distinctly seen. The man who shoots his rival in love or business is not in a crying frame of mind; neither is the Malay who runs amuck killing every one he meets until he is himself destroyed. Hatred, envy, sullen rage, do not take on this form of expression. The dagger, tooth and claw are not symbols of crying. Anger can be defined as a pleasure in inflicting pain. Biologically we have in anger a condition of action in which vision cannot well be blinded by tears. Even in hatred, jealousy, and envy, which are called passive forms of anger, the keenest vision and the highest degree of sense alertness are demanded; with it a soberness of mind typically expressed in generalship and financial competition. So too in the war *cry* of the savage, the conditions of the crying state are absent; the word "cry" here is employed in a derived sense. The feeling here is not one merely of anger, but expresses an idea of social action quite the opposite of the true crying state. In other ways the word cry has come to be attached to states that are related only symbolically to the crying state. In the "cry" of the auctioneer and the street pedlar, the metaphorical and symbolic meaning of the word and its remote connection with the idea of appeal is clearly seen.

In the cry from fear there is the element of helplessness and sorrow as we see well in the derived and mixed fear states such as apprehension and dread where there is the element of depression and diminished vital and motor action. The same is true of physical pain.

In the cry of joy, there is a mixed emotion, attended with intellectual elements. Those states in which laughter and crying alternate are similar in nature, as when one is severely tickled or tantalized. The cry from joy, as when the girl meets her parents after a long absence, contains the element of hopelessness through association with other elements, and the mind goes back to the time before it was emancipated from the strain of the, for the time, irremediable loss. Possibly the sense of the loss is heightened by contrast with the present relief. In the moment of any great success the memory of the severity of the struggle toward the end is probably present to supply the needed mental element to construct a crying situation. In the cries of joy there is a sense of being helpless, conditioned, or carried away by the force of a power that is beyond the control of the individual and heedless possibly of our safety or pleasure. This is especially evident when overcome by a sense of the sublime. The alternations of feeling help to raise the tension and nervous excitation. Where in this alternation the joyful element preponderates we have the laughing cry instead of the crying laugh. The two conditions are identical, and the physiological result at any moment is due to the dominance of the one or other of the states of pleasure or displeasure. In both, the previous conditions are similar, namely, a strained, serious, anxious state of mind.

Crying, if our analysis is correct, is essentially a condition that, though varying much in form and expression, is one in the sense that it always contains the common element of sadness, helplessness, or hopelessness. The cry is the physical accompaniment of a mental state which is a recognition of an inability to remove certain painful or oppressive conditions; the cry appears when the feeling has reached a certain intensity. We must remember that pain, if we accept the present verdict, is connected physically with a state of disintegration whether this be in the form of temporary painful state or the fixed conditions of melancholia and other mental abnormalities. It seems likely that all painful states of mind, when the intensity is great enough express normally, themselves in crying. The cry is a physical sign, writ large, of the insufficiency of the organism and primarily an appeal for help from without; in its most primitive form, a recognition that destructive forces are dominating and that the fighting chance has gone. The will to live has ceased and the whole organism is in a dying state.

The child's cry is largely an appeal to outside sources and is best described as a state of helplessness. In a deep stage of grief, better shown in the adult, the helplessness becomes hopelessness, the individual gives up the struggle to adjust himself to the demands that are made upon him. This cry is characterized by quietness of expression and seclusion, and a prone attitude of the body, suggesting the abandonment of life, which is common among many gregarious animals when they are overcome by disease or weakness and are destroyed by their kind, and the custom among nomadic savages, according to which the old and injured are disposed of, or voluntarily leave the horde and go away to die. Thus does the sorrowing human in modern life suggest the state of mind in which, to be burdened beyond the power of self to throw off the incumbrance, is to be worthless and socially unfit to live. The many suicides in grief, which are but a positive expression of the state that essentially exists in all mourning, illustrate the nature of the crying condition. The holding of the breath so common in the cry of anger is possibly rather an instinctive than a voluntary expression of the widespread cessation or inhibition of the vital processes that occurs in this state.

Co-ordinate with the deeper seated physiological stagnation in the condition of sadness that we have called a dying state, a dying state of mind is shown in the surrender of the processes of mental adjustment, quite in keeping with the slowed circulation and weakened condition that occurs in all stages of genuine depression, whether normal or abnormal.

We are now in a position in regard to the facts of crying to construct a partial summary. Crying appears to be a reaction that occurs in connection with many apparently diverse states, such as anger, grief and joy, and a provisional classification has been made into these three classes. Each of the forms proved to be widespread, and, so far as could be determined, universal among the races of mankind. Certain age differences affecting the cry came out clearly; the child's cry is more often active: it is noisy and plainly directed outward, and for the most part seems to be the result of inner needs. The child cries more often from anger, the typical adult cry is from grief; it is quieter, tends to be subjective, the victim seeks seclusion. Its occasions are more complicated. The child cry is essentially an expression of helplessness, largely in regard to bodily needs and desires: the cry of the adult is more an expression of hopelessness. There is the feeling of quite as much need, but the cry is no longer directed outward for assistance.

The cry is a profound disturbance, a large reaction, and no mere shedding of tears. It occurs as the end phenomenon of a cumulative development of feeling, a physical dualism which

is characterized by a low stage of energy, or a stagnation of activity, accompanied by a condition which requires an effort out of proportion to the power of the organism. In the typical adult cry this schism between the power and the need increases until the outbreak of the cry comes. Whatever else the cry may be, it is a cessation of the state of strained effort, in the direction of a total giving up. The state of adjusted motor co-ordinations and attention, which the individual maintains normally in all situations of life entirely ceases; it may be said that in place of a definite adjustment of nervous mechanism a state of wide diffusion quite the opposite of adjustment supervenes and movements are no longer adaptive. Both in the crying state itself and in the antecedent periods of tension and depression, the condition is one which suggests death, in the sense that it is a cessation of normal function. The will maintains the struggle after the disintegrative processes of pain are expressed in the physical inadequacy to respond to the demands of the situation. All cries can be reduced provisionally to this typical form.

The presumption is strongly in favor of the view that a reaction so uniform in its characteristics and so widespread over the human race is instinctive in its actions. Doubtless it has been preserved in the race because it breaks up a condition of strain of adjustment, which is kept up in the face of pain, to the exhaustion of the nervous energy. Pain is the first warning of the need of the organism to cease effort. Crying acts as a second but more uncontrollable interruption of the authority of the will, when, as it were, the body takes the situation to itself and prevents the further continuance of the effort. Whether this act is in any other respect than as a mere interruption, a beneficial act, remains to be seen.

It remains to study the cry as a series of definite, particular physiological and motor events, in order to discover if possible why under situations such as have been described the organism reacts with this particular, very remarkable complex. Further light may be thrown upon the question of the instinctive nature of the cry and the significance of its elements, by a study of its effects.

II. The Crying Act; Analysis and Effects.

In the previous chapter some conclusions were reached about the relation of the outbreak of crying to the causes and conditions under which it occurs; it now remains to examine the actual event with reference to analyzing it into its elements and to study each of these as a physiological act, with two questions in mind; first, the genesis of the particular form which the expression of grief has taken in the human race in the act

of the cry, and second, the effect of this act which has led to its widespread adoption or its preservation as a means of expression. The first chapter had to do largely with the question as to why we cry; the present chapter with the question why we cry just as we do.

We shall find that the explanations that have been suggested and the conclusions from the present data lead to a classification of the explanations of crying into two groups, the first, mechanical or physiological, the second, biological. Each covers, in a way, the questions as to the reasons for the particular events that occur in the cry and its preservation in the race, on the ground of its effectiveness. It may transpire that these views are not entirely antagonistic to each other, but represent partial truths.

The crying act, as was said above, is a complex event, a series of motor and physiological changes, that sweep over the nervous system under certain conditions. Crying is not merely a shedding of tears nor is it entirely expressed in the changes that appear externally. It is very widespread in the body, and involves obscure as well as more obvious events. But the whole process, both in its internal and external aspects, cannot be ferreted out in our present state of physiology.

Starting with the answers to the questionnaire as a basis, a provisional grouping of the changes that occur in the cry act can be made as follows:

(1) Changes in the circulation, (2) attitude of the body, (3) lump in the throat, (4) vocalization, (5) sob, (6) tears.

The complexity and wide range of the cry can well be shown further by a brief statement of the common physiological information in regard to the nervous mechanism that is involved. The act of crying is due to action of the fifth, seventh, ninth, and tenth cranial nerves together with the superior cervical sympathetic. The secretion of tears is due to stimulation of the fifth and sympathetic, the alternate paling and flushing to the sympathetic, while the consequent general stimulation of the respiratory centre results in the sobbing and general convulsive movements of hard or continued crying. Various other nervous phenomena, such as cold hands, are due to disturbance of the sympathetic system. When the anatomical relationships of the tenth nerve are recalled, the various vague body sensations that accompany crying can readily be understood as also the profound depression that so often follows prolonged crying, for the pneumogastric is thought to have a "depressor" cardiac branch. It is certain, at any rate, that, in the lower animals, strong or prolonged stimulation of the pneumogastric stops the heart. Some of these physiological facts will be discussed more in detail later. But this will be sufficient to show the nature

of the nerve mechanism which must be taken into account in a description of crying.

Circulation. Altogether a disturbance of the circulation has been mentioned fifty-four times in the returns. Thirty-five speak of a change in the complexion; twenty-five have noticed redness of the face; three mention paleness. A black or purple color, in the case of children, is described. Others speak of the red face and cold hands; hot hands are also mentioned and the fact that people differ much in the circulation accompaniments of crying. The changes in the rapidity of the circulation also appear to differ from case to case. Ten writers express the belief that the circulation is accelerated: eight of the number seem to have inferred this from the redness of the face; but this does not necessarily follow.

The indefinite expression "increased heart beat" occurs; there are "throbs in the head." Another says more definitely that the heart has been retarded in rate but beats more violently. One other observer has recorded a retarded circulation. Other references to circulatory changes are made in describing the after-effects of the crying spell; such as bloodshot eyes, the mottled complexion, parched and distended lips, and burning eyeballs.

While these returns do not allow conclusions in regard to the exact changes that occur in the circulation, the variety and generality of the vaso-motor disturbance is clearly indicated.

Attitude of the body. In tabulating the returns for the purpose, it was clearly shown that in the cries of anger, fear and pain, there is a larger amount of body movement and facial contortion than in the grief cry. These movements in the angry cry are very diffuse. In the one hundred and twenty-two descriptions of the angry cry, forty-four references were made to the throwing of the limbs, kicking or striking in an aggressive manner or bumping the head upon the floor. One writes that in the angry cry there is not a feeling of weakness or despair, but a feeling of strength or desire to fight. In pain there is a writhing of the body and throwing of the limbs. With these movements goes the suspension of the breath and resultant black or purple discoloration of the face, a condition limited to the cry of pain and anger.

In the cry of sorrow, on the other hand, there is the attitude of lassitude, especially preceding the spell. One speaks of a feeling of weakness during the cry; another of such exhaustion that she "can't stand up." Feeling of "weakness in the chest," "utter weakness, especially in the knees," are mentioned, also a tendency to the prone position of the body as characteristic of the cry of sadness. The prone position was mentioned forty times and the "erect" but once. The fact that

lying down increases the tendency to cry, and negatively that "one gets over the crying spell more quickly if one remains standing," is brought out in the returns. It was noticeable, also, that the vocalization disappears in this form of the cry. Even in the child the vocalization is subdued in pitch and becomes the plaintive moan or wail in the sadness cry. The influence of the prostrate position of the body in quieting a child is mentioned and the fact that one cannot indulge in the abandoned cry while in a standing position.

The historical and ethnological material is full of reference to the bodily attitude in the cry. To give a full account of this topic would necessitate describing mourning ceremonies among various peoples. Of these there is a great variety. The grief expressions and ceremonies as described in the Bible illustrate the manner in which, to the common elements of movement and attitude which express grief, various ritualistic elements are added, and the manner in which grief becomes formulated and conventionalized. We read of the "virgin girded in sackcloth and ashes for the husband of her youth." (Joel 1: 8.) Ahab in penitential mourning "rent his clothes and put sackcloth upon his flesh," like a man sorrowing for the dead. (I Kings 21:27.) In a wall painting of an Egyptian tomb a funeral procession is represented with the master of ceremonies "followed by eight women and four men, . . . all making gestures of mourning, by beating their breasts and their mouths while wailing, or by throwing dust on the head." (16.) To tear the hair and the beard (Ezra 9:3); to put sackcloth and torn garments upon the body (II Samuel 3:31); to sit among the ashes (Job 2:8); to sprinkle earth or dust or ashes upon the head (II Sam. 13:19) were actions in which sorrow and grief more or less naturally or conventionally expressed themselves. . . . . To go "bowed down heavily" (Ps. 25: 14); to go barefoot and bareheaded and to cover the lips (Ezek. 24:16, 17; Mic. 3:7) were less demonstrative tokens of mourning. Mutilation of nose, brow, ears, is mentioned by Herodotus (4:17) as being practiced by the Scythians in token of mourning for a departed king. Such mutilations were forbidden by the law of Moses. (Lev. 19:28; Deut. 14:1), although we read of making bald the head and cutting off the beard (Isa. 15:2) and even laceration of the body as a sign of vexation and grief among the Israelites. Among the Arabs it was customary for the women both to scratch the face until the blood ran and to cut off the hair (16).

The following refers to the Kiowa Indians: "The men also have their hair cut off at the shoulders, and had discarded their usual ornaments and finery. On one occasion while driving near a camp we were attracted by a low wail, and going to look

for the cause of it we saw sitting in the tall grass near the roadside a bereaved father, stripped to the breech cloth, his hair cropped close to his head and blood dripping from gashes that covered his naked body. He did not look up nor turn his head as the wagon passed, but continued the low wail with his eyes cast upon the ground." (29.)

An ancient custom among some North American tribes was of a woman, on occasion of the burial of her husband, to cut off a portion of a finger (one or more joints) and have it suspended in a tree above his body. (49, pp. 109-110.)

The great mass of this testimony goes to show that the expression of sorrow, as developed into rites and ceremonies, is made on the basis of self-torture and abasement. The positions that are assumed are those of resignation, abasement, humiliation and neglect or active abuse of the body. These motions of withdrawal and prostration are in keeping with the natural expression of grief as it appears in a civilized child and adult in the prone position; the rite is a voluntary attempt to carry further an instinctive reaction. In a professional mourner the expression of grief has become conventionalized and he performs for all, the acts of self abasement which are the essence of the rite.

Vocalization. In childhood, before vocal language has been developed, the vocal cry is essentially an instrument of expression. This is well brought out in the returns and confirms the facts already conceded by students of language. The specific cries of hunger and pain were noted and the fear cry and the cry of anger or "spunk" are also mentioned. The child "tells" when he is hungry, cold, or in pain by his cry. (7, p. 91.) It is recognized that in the vocalized cry of the infant he is calling attention, and that the cry of the older person is for the purpose of giving "vent" to the feelings, and that as one gets older the vocalization is "suppressed."

More specially to describe the vocalization in the old and in the young, such words as "shrill," "a howl" are used in characterizing the cry of the infant and the young child. Compared with the adult's it is more "vehement," "louder" and "higher." The cry of the child is thought by some to be intentional, while that of the adult is repressed. In describing the vocalization in the cry of "old and young," such words are used as "harsh," "scream-like," "emphatic," "shrill," "a wail," "sharper," "louder," "more prominent, but with less of feeling," are used with reference to the latter. On the other hand, the absence of vocalization is frequently mentioned with reference to the old, and when it is mentioned it is usually spoken of as subdued, quiet, of a lower pitch, suggesting a state of feeling of greater depth. It is "muffled," "faint,"

"restrained," "a gurgle," "moan," a "sniffle," "weak, but with more tears," "more subdued," "more quiet," "less loud," "more feeble but more heart-rending," "more heavy, and deep because controlled," "consists of sobs and gasps only."

The voice is mentioned in but seven of the actual descriptions of the adult cry and in the replies to other questions. In one of these it is said that the vocalization is produced by the attempt to speak, in two others it is characterized as harsh. That, however, in the adult the vocalization tends to return when the grief is extreme, is suggested by the returns. The restraint that is exerted upon the adult cry by the presence of others is mentioned, and the fact that when grief is extreme, this is overridden and the cry takes on more of the infantile character.

Coinciding with the unmistakable fact that vocalization is more pronounced in the cry of the infant and young child, is the evidence of a similar distinction between the cry of the savage and the cry of the more civilized races. For example it is said of the Esquimaux about Behring Strait, that "when a person dies during the day, his relatives amid loud wailing, proceed at once to dress him in the best cloth they possess," etc. (46, p. 272.) Of the Sia, a tribe in New Mexico, we read: "The immediate relatives in consanguinity and clan, are present during the bathing of the body, and make the air hideous with their lamentations" (43). Of the Sioux, it is said that after the death of the warrior, the widow cuts her hair, mutilates her body with a sharp flint, and meanwhile "keeps up a crying and wailing." "After depositing the body . . . they continue exhibiting their grief, squaws by hacking their arms and legs with flint . . . the men would sharpen sticks and run them through the skin of their arms and legs, both men and women keeping up the crying generally for the remainder of the day, and the near relatives of the deceased for several days thereafter. . . . Similar mourning was kept up at the death of women and children. It is not unusual, at the present time, to hear a man or woman cry and exclaim, 'Oh, my poor wife, or child,' as the case may be, and upon enquiry to learn that the death happened several years before." (49, pp. 109-110.) The males of the Heada and Tlinget tribes were said to have "childish fits of crying." The cry of the Samoan women was spoken of as "very noisy;" and by another writer the crying of both sexes of the Samoans was described as "natural and childish." The word childish was also applied to the crying of the Hawaiians. Of the Yo-Kai-A Indian it is said "The chief of the visiting tribe made a brief speech in which he no doubt referred to the death of the chief of the Yo-Kai-A, and offered the sympathy of the

tribe in their loss. As he spoke some of the women scarcely refrained from crying out. I presume that he proposed a few moments of mourning, for when he stopped the whole assemblage burst forth in a bitter wailing. Some screamed as if in agony. The whole thing created such a din that I was compelled to stop my ears. The air was rent and pierced with their cries."

Free vocalization in the cry is abundantly attested in the Bible as having been practiced among the Hebrews. This is noticeable even in the cry of joy, for "Jacob kissed Rachel and lifted up his voice and wept" (Gen. 29:11). When Esau heard the words of his father, that Jacob had secured the blessing originally meant for him, "he cried with a great and exceeding bitter cry" (Gen. 27:34). On seeing the self-sacrifice of his brother Judah in offering to sacrifice himself for his brother Benjamin, Joseph was touched, "could not refrain himself before all that stood by him . . . and he wept aloud." (Gen. 45:1, 2.)

Other evidence suggests that as the cry becomes formal and ceremonial the depth of the feeling may not be in very close relationship to the intensity of the expression, that it is the deeper feeling that is naturally related to quiet crying and tears, that naturally the expression is vocal only when the tears are insufficient as a safety valve to the emotion. This loud wailing of the savage is probably often unaccompanied by tears, as in the case of the Kanaka, of whom it is said that "he cries to the utmost extent of human endurance, although tears do not flow so freely as the grief and sobs would indicate." Another writer describes the crying of these, as loud and easily repeated on slight occasions. "Between the arrivals of the friends of the dead, those already present indulge in laughter, and feasting. The grief at the public funeral of the Maoris was described as only partly real. It was marked by a long mourning wail which was "all over as if by magic; after which they indulged at once in feast and laughter." The Samoan's grief is "soon forgotten." (From missionary returns.) Of the Yo-Kai-A, Stephen Powers said, "at a given signal they ceased weeping, wiped their eyes, and quieted down. Then preparations were made for the dance" (49, p. 193). These and other facts indicate that among savages the crying act is largely built upon by custom and ceremonial. Crying becomes a profession in the mourner. The "louder" they can cry the "more expert" they are regarded, as among the Hawaiians.

Some differences in the vocal cry of races have been carefully described by Mantegazza. Among the Niam-Niam it is "Ow, ow" to "okoun, okoun," in intense suffering; among the Bongos, "aoh," the Dyor "awai, awai," the Papuans of

New Guinea, "ac," the peoples of New Hanover "se, se" (27, p. 259). The Samoans, according to our returns, cry "aue, aue." The quality of the intonation has also been mentioned in the ethnological returns. The close relation of the cry to musical expression is also indicated. The dirge of the professional mourners among the Hawaiians, is said to have a most touching character, and "to follow the scale as accurately as our musician does his song." Among the negroes the vocalization of the cry takes the form of the funeral moan or chant. Among the Indians tears are attended with a song recounting the good qualities of the deceased.

The data in regard to vocalization in the cry indicates the essential oneness of the crying state. The natural expression of the crying state is the vocal cry, which is a call in a state of helplessness. This primitive fact becomes modified in many directions, and, like all useful expressions of emotion, is highly developed. In the adult cry of grief we find the vocal cry suppressed, but that it is a suppression is indicated by the fact that it occurs again when the state of feeling is intense. The savage as an adult not only freely expresses the mental state of grief by vocalization, but makes use of it as a ceremonial, and voluntarily increases it just as the child does when he cries voluntarily for attention or sympathy, but for quite other purposes. In the "hopeless" stage of the adult cry, the cry is no longer for help and our customs place a ban upon loud expression of grief. Observation leads to a conviction that there is considerable difference in this respect in the expression of grief in the higher and lower classes in our own communities.

The lump in the throat. The lump in the throat has been so commonly referred to in the returns as the first symptom of the coming cry, that the fact must have some significance though the returns are not sufficient to establish the point beyond suspicion. In answer to the questions in regard to the nature of the lump in the throat as felt, its repression, its effects upon the voice, respiration, complexion, and circulation, the following characteristic phrases were used:

"It comes just before the cry; cannot swallow;" "pain or ache in the throat;" "feels like swallowing the larynx;" "increases with the attempt to swallow, unless the mouth is opened and the face is straightened into its natural position;" "it may be suppressed."

The effect of the lump upon the respiration is indicated in such expressions as "makes it difficult to breathe," "almost choked." "It will move neither up nor down." "The throat feels full." "The breathing is hard and strained." Twenty-two of the thirty-six answers relating to the respiration declare that the breathing is made more difficult. In addition to these,

there are seventeen references to the loss of breath in the crying spells of childhood. Thirteen of these refer to the cry of anger, and four to fear.

Forty-eight have noticed a disturbance of the voice, while only one declares that there was no such disturbance. One says, "It feels as though something came up into the throat and stopped the respiration and the vocal organs, a kind of catch in the throat, making breathing difficult and speech almost impossible." Another writer says, "A hollow aching lump seems to rise in the throat until in the back part of the mouth; this quickens and shortens respiration and causes the voice to be weak and broken." It "cracks the voice," "hinders respiration," and sometimes "entirely cuts off the voice." The words, "guttural," "husky," "harsh," "choking," have been used to describe the nature of the disturbance of the throat. Four have noticed the increase in the lump in the throat when the effort is made to suppress the tears. Others say: "The tears relieve the lump;" "must cry to get rid of the lump." "The lump is more noticeable if one is with people and tries to suppress the tears—" One gives an explanation. "The feeling is caused by the tightening of the muscles of the throat to prevent the convulsion in the breath, that naturally takes place when one cries." The progressive development of the lump, and its relation to the sob, has also been observed. "It grew larger and larger until the first convulsive sob: then it seemed to stop." With another the lump continues throughout the cry. Four are unacquainted with the "lump" sensation; one thinks that it is not always present; another "has not felt it since childhood."

The data in regard to this interesting symptom of the cry are insufficient to warrant a physiological interpretation of it. That it is connected with disturbance of breathing and vocalization appears certain. On the other hand it is connected with movements of swallowing, and the relation of it to disturbances of the mechanism of the digestive tract is indicated.

The Sob. In answer to the question "What is the sob?" the following definitions were given: "a convulsive catching of the breath," "a convulsive choked drawing of the breath," "a natural tendency to hold the breath in extreme grief;" "one makes little gasps for air; these are the sobs;" "a convulsive sigh;" "a sob is a short, quick sound, which indicates the cessation from prolonged weeping." "It occurs at the end of the spell and lasts for some time." Other definitions are "a convulsive contraction of the diaphragm," "a convulsive drawing of the breath," "a sharp drawing of the breath," "a choking sound made in the throat, accompanied by a convulsive movement of the shoulders, or of the whole body, coming at regular and fre-

quent intervals;" "a short and rapid inhalation, two or three for each exhalation culminating in a fit of gagging and grimaces, and gradually diminishing in rapidity to about one in twenty-five seconds." Another records the fact that the sobbing is more rapid at first, perhaps five or six in a second.

Other remarks refer to the control of the sob. "The sob is the most difficult part of the cry to control." "Outside influence can have an effect upon the other symptoms but the sobbing continues."

The relation of the sob to the vocalization is indicated. "A deep and agonizing breath suddenly expelled and another deep breath taken." The sob is thought of in three cases as the vocalization of the cry. The expression "sobbed aloud" occurs.

The late appearance of the sob and its relation to the shedding of tears have caught the attention of the observers. "The sob continues later than the tears." "It generally follows but may accompany the tears." "It comes after the tears." "Tears give way to sobs;" "most noticeable after the tears have ceased," at the end of the cry. "I always sob for a long time after the tears have ceased." Another, speaking of the order says, "the tears cease to flow, the lump begins to disappear, the sobs slowly cease." Preyer says, "not weeping but the sob comes late."[1]

The order of events in the cry of a Japanese child was especially observed by Dr. Theodate L. Smith. At the 7th week it was as follows: (1) Drawing of the mouth to a square shape (in the 12th week a protrusion of the lower lip preceded crying); (2) closing of the eyes; (3) the vocal sound â â â; (4) reddening of face; (5) tears. The crying was not accompanied by snuffling, and there was no indication of the sob as late as the 7th week, except its possible beginning in a slight catching of the breath. In the 9th week sobbing was clearly present.

The reddening of the surface that accompanies the cry was definitely observed in the 9th week. It began in the face, spread up over the top of the head, and simultaneously down toward the feet.

The early appearance of tears in this child (almost from birth and certainly within the first forty-eight hours, according to the records of physician and nurse) is exceptional.

As early as the 7th week the vocal cry was well differentiated and the cries of hunger, pain, discomfort, sleepiness and anger clearly distinguishable from each other.

Observations in regard to age differences—"In the child the sob is usually the climax; in the adult the cry often begins

[1] Some observations upon the development of the sob and other points that were received too late to incorporate can be mentioned together here.

with the sob." Another describes the typical adult cry "as sobs and gasps only;" or "only sobs, tears occurring but occasionally." These examples suggest that the sob plays a larger part in the crying of the adult and appears earlier in the crying act. The explanation is that the sob persists at a time of life when other elements of the cry have been inhibited. The sob also varies with the nature of the feeling which accompanies the cry. Ten have noticed that sobs accompany the angry cry but four have also mentioned that there is less sobbing than in the grief cry. One reports that the sob is present in the cry of joy.

The sob appears to be absent in the young infant, and its first appearance is recorded at about the time when tears also appear, not perhaps until about the end of the fifth week. The sob appears to be an entirely human manifestation of grief. Darwin records that the "monkeys scream and pant but do not sob." (7, p. 157.)

There is little explicit mention of the sob in the ethnological returns. Its absence has not been observed among savage peoples, and its presence seems occasionally implied, as in such expressions as "a perfect outburst of uncontrollable grief" in the case of a male Indian. That some, at least, of the Indian tribes sob is shown in the above (49, p. 103) referring to the Yo-Kai-A tribes of California, which says that when a visiting chief referred to the dead chief of the tribe, "with difficulty they suppressed their sobs." Among the Sandwich Islanders, the sob is said to be pronounced. The sob is probably universally, as well as distinguishingly human.

According to these definitions and descriptions the sob consists (1) of a deep and violent inspiration, opposing a tendency to choke. It seems to be due to a spasmodic contraction of the diaphragm, the choking being caused by a partial closing of the glottis, and constriction of the vocal cords. When the sobbing is most violent, the interruption may break the inspiration into a series of broken fragments and a gasping sound may attend the vibration of the vocal cords. A like spasmodic movement, though less pronounced, may attend the effort to expel the air, the air passages continuing to remain constricted. The term sob is often used as including this movement of expiration. This phase seems to be the last stage of the vocalization, the remnant of the unrestrained "a-ha-ha" of the child cry.

It is probable that the breaking of the rhythm in the respiration belongs both to the inspiratory and expiratory movements. Expiration is less under muscular control; the catch in the inspiration is partly at least an effect of broken muscular innervation; so that just to the extent that the expiration is muscular it partakes of the jerky character of the whole muscular process.

The sob appears to be a later symptom of the cry persisting after the flow of tears has ceased. In a case recently observed, the child was seen after tears had ceased; the marks were still upon the face, vocalization had also discontinued, but he was still sobbing violently with a movement much like hiccough. This appears to be typical. The late appearance or the persistence of the sob as an element of the cry is clear enough but the time of its appearance is less easily determined. The evidence is not conclusive but it is indicated that the sob appears after and relieves the lump in the throat. Yet in some cases it was observed to be present, at least, as a tension of the diaphragm, when the eyes were merely suffused with tears, and the sensation in the throat scarcely noticeable; it was then apparently simultaneous with these symptoms. It may not only persist after the tears have discontinued but it may appear in a paroxysm that involves no shedding of tears at all. The sob seems to be essentially human, though it is not necessary to the crying spell; tears may flow without it. It seems to be characteristic of the climax of the cry and is probably always present when the paroxysm is intense. It seems to be always absent in the cries of animals.

These points are still further involved by the fact that in the adult and in cases when the stimulus is intense, the crying may begin with the sob. It is quite possible that there is always in the cry a disturbance of the respiration, but that it does not always appear either to outside observation or to introspection, unless it is pronounced.

There is no certain testimony in the returns as to the location of the beginning of the convulsive movement of the cry. Twenty-five observe that the throat is prominently affected. But some other part of the body is usually also mentioned as prominently affected. The diaphragm, the chest, abdominal walls, stomach, lungs, thorax, or the abdomen as a whole are repeatedly referred to in the papers.

Some anatomical explanation for these varied phenomena is found in the wide distribution of the pneumogastric nerve, and its intimate connection with the solar plexus of the sympathetic system.

Tears. The young infant does not shed tears, and the age of first appearance in sufficient quantity to be seen upon the cheek varies from two to five months, according to different observers. According to Darwin's observations, they first appeared at 139th day (7, 153). But he quotes others who place this date at 20, 84, 110, 104 days. Preyer observed tears on the 23d day (33). Perez places this onset at between two and three months (32, p. 66), while Mrs. Moore has observed their appearance as early as the sixteenth week (30), Miss Shinn at one month (41), Lowden, at 53 days.

After their first appearance they remain throughout life connected with the typical cry; they may remain as the only visible symptom of the cry. In regard to the time of appearance of tears in the paroxysm, the returns are not conclusive; fifty-five say that they are the first symptom to appear; sixty-three say that the lump in the throat precedes.

The proportion of the entire spell over which tears continue is also not definitely determined. There appear to be individual differences. In some cases tears cease early in the spell; in others they persist. But all who mention the point maintain that the tears cease before the end of the crying as a whole. One says "about two-thirds of the whole period;" another speaks of the dry sob remaining after tears have ceased.

Running of the nose during crying is mentioned in some cases. This indicates that a portion of the tears have passed down the nasal duct instead of overflowing in the eye.

The rate of secretion of the tears appears to be another variable characteristic; in some the rate is said to be faster at the beginning of the cry; others say that tears increase as the crying continues. Excessive shedding of tears seems to be an idiosyncrasy. They appear to be much more easily stimulated in some than in others, perhaps quite independently of the amount of feeling. Instances are given by the correspondents: as, for example, a man who always sheds tears when he reads anything that is in the least pathetic. Altogether twenty-eight cases were mentioned among the returns in which there was said to be a tendency toward excessive shedding of tears. The absolute capacity of the glands is sometimes very great. Darwin tells of an idiot who cried the entire day on discovering the æsthetic blunder of having shaved his eyebrows to promote their growth. (7, pp. 155-156.) Other cases of long continued shedding of tears were mentioned in the returns. One had the eyes continually suffused with tears, so that it was necessary to repeatedly wipe them away.

Tears are but little under direct control of the will. Three-fourths of the answers to the question as to whether tears can be repressed, contained the statement that they cannot, or gave conditional answers. One says, "only for a time." Another, "only when the feeling can be conquered.' "It is impossible when one is alone or when the influence of society is wanting." Similar conclusions are reached by the observers in regard to artificial crying. In this connection it was said by fifteen of sixteen observers that the tears are the hardest part to manage. One says "Unless I am really sorry, I can never shed tears." One found that, in trying to cry, she could sob, and bring the tears to the eyes but could not shed many nor get the peculiar sensations of a real cry. Others seemed to manage better and

one relates that "if the face was contorted, tears would flow and a feeling of depression would follow." Another: "I took part in a play in which I was obliged to feign crying. After a little I began to sigh and moan, and in a short time I was really crying." A well-known actor was asked how he managed to weep at will, and replied, "I call up the image of my dear father, who is dead."

It is likely that most of the instances reported are cases of manipulation of the feelings rather than direct control. All the accessory efforts are probably merely mechanisms that result in conjuring up the sad feelings.

The effort to excite tears deliberately implies their intimate relation to a depressed feeling since their effectiveness consists in exciting a sympathetic feeling in the minds of those to whom they are addressed. That "tears are woman's most effective weapon" we are continually reminded in our returns. All except two of fifty writers who have described the effect of tears of parents, teachers, and friends, upon their conduct are agreed upon the great effectiveness of tears to conquer a stubborn will or subdue passion, when everything else fails. "They caused sorrow and regret over my misdeeds." "They affect me when nothing else will." "I never saw my mother cry but once and that moved me more deeply than anything else in my life." "When my parents or friends cry over my conduct I feel ashamed of myself, and make resolves to be better in the future."

Tears, although, of course, common in both sexes, and more common in women than in men, are possibly more frequent in proportion among the males in some races than in our own. The crying of both sexes has been especially mentioned in writers about the negroes, Indians in the Heada and Tlinget tribes, the Japanese, the Samoans, the Sandwich Islanders, and the Maoris. The evidence is strongly in favor of the view that tears are more frequently shed among the lower races of mankind than among civilized peoples. A Maori chief cried like an infant because certain sailors sprinkled flour on his choice clothes (7, p. 155). Children also shed more tears than adults; it seems to be the current opinion among the correspondents that tears "last longer" in childhood, but there is no conclusive evidence. Some who have answered the question have doubtless been led astray on this point by inferring that because children "cry" more they shed more tears. Many of the cries of the young child are vocal in their nature and tears are entirely wanting. This is especially true of the angry cry. Of the angry cry it is said "the flow of tears was not very great." Of twenty-nine who have referred to the tears in the angry cry, fourteen observe that they are less frequent, and

eight declare that they are characteristically absent. In two cases of the five in which tears were mentioned in connection with the cry from fear, the tears were said to flow only after the danger was over. That the active form of the cry from fear is tearless, is suggested by the answers to the question about the inhibitory effect of fear upon the cry. Fourteen out of twenty-one say that fear inhibits the cry. One says that intense fear inhibits crying; another that if fear is not too intense, crying will result. The transition from this upper limit to the tearful level is indicated in such replies as the following: "Fear is likely to cause numbness at first, and then tears." In general the active element in the emotional state inhibits the tears though it may not have any effect in lessening the vocalization, and may increase it. In fear, for example, the more intense form is one of inhibition of both movement and the cry, then at a little lower level screaming predominates, and in the fear that is more largely representative, tears are more common and they may flow freely after the shock of the fear is passed.

Intensity of emotion, even of sadness, seems to have the effect of inhibiting the tears. Some report that they cannot cry when they feel the saddest, which evidently refers to the tears, since other elements of the cry are more under the control of the will.

The shedding of tears from grief has also been noticed among the higher animals. Darwin reports that "the Indian elephant is known sometimes to weep . . . . when captured it sank to utter prostration, uttering choked cries, with tears trickling down the cheeks," and again "the female when distressed by the removal of her young one contracted the orbicular muscles when the trumpeting began." Darwin also reports that one species of monkey, the Macacus Maurius, is known to weep copiously. (7, p. 167.)

Effects of Crying. The following examples will show the nature of the facts with which one must deal in treating of the effects of crying:

F., "If it were not for crying I think people would go insane, not having any way to give vent to their feelings."

F., 18. "I feel as though some one had been talking kind to me and a great load had been taken from me."

F., 23. Speaking of despair, "It was always felt before the crying spell, but never after."

F., 19. "After my crying spell I am sure I felt much relieved. The nervousness was gone and I was ready to enjoy life once more."

Among the fifty-seven responses, referring to the adult period all but three express somehow the notion that the effect of crying is good.

The following refers to childhood:

F., 32, a mother. "Unless you can divert them let them cry as much as they can; as a rule they appear to be relieved after crying."

Others refer to the common belief that a baby that cries much is healthy. In seven of the forty-five references to infant cries, the cry is said to be a good means of exercise; that it strengthens the lungs and the vocal cords. The remaining answers refer to the use of crying as expression.

All except two of the twenty-one replies concerning adolescence that refer at all to the expressive significance of the cry also declare the beneficial results of crying. They say "it is good," "a relief," "acts as a safety valve."

The exceptions among these returns emphasize the fact that there is a limit of prolongation or severity beyond which the cry is not beneficial but harmful. One says that although crying relieves the feelings, too much will weaken the power of control. Another, "A limited amount is good." "It is bad for anger, good for grief." "The child should cry when in pain or grief." "The effect is good if the cause is genuine, and the crying is not too hard."

Many other expressions are used to describe the benefits of crying and its limitations.

Seventy-one of the ninety-four descriptions of the cry without objective cause also report the favorable results.

These are typical:

F., 18. "I have an uneasy feeling as though I could not sit down and do anything. After a good cry I feel greatly relieved. It seems as if a great weight had been lifted from me."

F., 21. "I always feel relieved after such a spell, and things generally look bright to me."

F.,— "I have often become so tired, discouraged, or nervous over work and worry that there seemed nothing else to do but have a good cry, and after one has cried a long time relief comes."

F. "A cry sometimes relieves one of that pent up, stuffy feeling and seems to lift a burden that has been resting upon one. Too much repression is bad for the body and the mind both; the mind will not work."

Among the answers to the question in regard to unforced fits of crying, or of "pure misery" in childhood, forty-six of the sixty-one who refer to the effects declare that these were beneficial, giving a sense of easing, refreshment, or relief.

Altogether there is abundant evidence to show that in all of the kinds of crying, except the angry cry, though the immediate physical effect is possibly bad, the mental relief is great, and this seems to be true of all periods of life.

One says, "Although I felt exhausted and sick from crying so much, nevertheless I felt relieved," "I was mentally relieved but physically tired." This state of affairs is repeatedly mentioned in the papers, with a great variety of phrasing.

The termination of the cry by sleep is frequently spoken of especially in the cries of the adult. This is quite what would be expected in the typical condition after the crying spell, physical exhaustion and mental relief. There is relief relative to the previous condition of excitement and a diminished store of nervous energy. Compared with the great distress of the mental strain and unpleasant associations, the physical exhaustion is pleasant; it is like the tired or exhausted state that ensues after a hard day's work, pleasant, if the exhaustion has not been carried too far. It is only when this limit has been passed, and we find the exhaustion greater than the relief, that the experience is predominantly unpleasant. If the physical exhaustion has been carried still further, the sense of strain and effort is not relaxed; the excitement goes on; restoration does not begin and pain is the exclusive result. When over-exertion is local merely, the result is a state in which pleasure and pain are mingled, as in the case of a physical pain such as headache combined with a strong sense of mental and physical relief

All of these characteristics of over-exertion may occur as end phenomena of a crying spell. The predominance of the pleasant or the unpleasant effect seems to be directly related to the severity of the spell. In every instance in which ill effects were reported as the result of crying, the spell has been said to be severe. The conclusion is warranted that the crying spell in itself naturally terminates in a sense of relief, and it is only in cases in which exhaustion occurs that this effect is obscured.

That the ill effects of a prolonged crying spell may be very severe is clearly indicated in the returns. Such expressions occur as "It is a great strain upon the nervous system;" "cried myself sick;" "there was loss of appetite, great physical weakness, and unusual activity of the heart."

Among permanent or long-enduring effects of crying are mentioned: headache, stupor, sickness, exhaustion, nausea, sore eyes.

So far as the references to crying in literature are concerned, it seems that, as compared with laughter with its similar physical reactions, the good effects of crying have been late in becoming recognized. That laughter is good both physically and morally has, according to Sully, become a commonplace to the students of literature. To quote his words "The unlearned, who know nothing of diaphragms, nor of congested veins needing to be relieved, have had a shrewd conviction that laughter sets the current of life moving more briskly. Proverbs such as "laugh and grow fat" attest this common belief. — The learned Burton (b, 1577) quotes a number of physicians in favor of the ancient custom to enliven the feast with mirth

and jokes.—Mulcaster, for example (born about 1530), gave a high place to laughter among his physical or health-giving exercise" (44, pp. 34-35). Yet in none of these accounts is the beneficial effect of crying mentioned.

But apparently it is only recently that crying has come to be recommended as a means of physical development. There is now, however, considerable reference in medical literature to the effect that crying is beneficial; that it is an exercise in deep breathing, and tonal expression. Others have recorded its therapeutic uses among the insane for the purpose of relieving mental strain.

Further light upon the question of the relation of crying to emotional tone is afforded by the replies to the questionnaire that have to do with the topic of distraction.

Inquiry was made as to the favorable influence of diversion as a relief from the tension of grief versus the effect of the crying spell; whether the diverting of the attention would relieve the tension permanently or whether there was a tendency for the stress to go on beneath consciousness and break out later. There are about an equal number of affirmative and negative replies on this point. When the cry is voluntarily repressed or attention completely distracted for a time, the tension does not necessarily remain relieved. When the stimulus is intense and the current of thought and feeling too strong for diversion, the relief seems to depend upon the power to cry; if the tension continues, and the victim is carried beyond the point when the natural reaction of the cry is impossible, a state of mind ensues which, in its extreme, becomes entirely abnormal and may go on to insanity. The natural expression of grief is the cry and grief that has passed beyond that stage is essentially abnormal. An instance of the effect of crying upon the state of tension is related in Tennyson's Princess: (45.)

Home they brought her warrior dead;
She nor swooned nor uttered cry.
All her maidens, watching, said
'She must weep or she will die.'

Then they praised him, soft and low,
Called him worthy to be loved,
Truest friend and noblest foe;
Yet she neither spoke nor moved.

Stole a maiden from her place,
Lightly to the warrior stept
Took the face-cloth from his face;
Yet she neither moved nor wept.

Rose a nurse of ninety years,
Set his child upon her knee—
Like a summer tempest came her tears—
'Sweet my child, I live for thee.'

The maidens were wrong in supposing that the outburst could be induced by *increasing* a sense of the bereavement. The experienced nurse knew that it must be diminished. From B. W. Richardson we quote, "As a rule the free escape of tears relieves the heart, and saves the body from the shock of grief. Tears are the natural outlet of emotional tension." Yet he notes that there are exceptions to this rule and "we have more than once seen uncontrollable weeping followed by serious symptomatic disturbances and effects, principally of the heart and circulation; we have known intermittence of the heart beats to be induced in this way, and to assume the most serious character." (37.)

It is said that women who are able to find relief in tears keep their youth longer than those who repress them. Concealment "like a worm in a bud" is not only a beautiful poetic conceit but a profound physical fact. In short, strong emotion should find expression. 'Give sorrow words.'

Dr. S. Weir Mitchell says: "I am very sure that the effect of moral tears on the child or the women in distress is to give a certain amount of mysterious relief, the ultimate cause of which it is rather difficult to determine. This also is quite certain in my experience with people who have suffered great grief and do not cry at any time, that they are either unusual types or fail for want of this secretion to get relief which has been of late obvious in other cases."

As Sully says of laughter that "as a light stimulus to the nerves, it does good by its occasional irruption into a domain which would otherwise have too much drowsy monotony," but that "its benefits are rigorously circumscribed" (44 a, p. 37); so we may say that crying is a similar interruption to overcome a graver condition. The good effects of crying are relative. They are relief from pain rather than a source of exuberance, vitality, and life. After a crying spell life is more often made tolerable than enviable.

Other effects of crying are seen in the cases of people who are normally given to strong self-control. Of the twenty-four answers describing examples of crying in persons usually self-controlled, eleven say that the result is physical exhaustion and prostration. In one case, the illness lasted for a month. Crying spells that occur after long control, as during the illness of friends, are likely to be especially severe and exhausting. One report contains an account of the difference in the effect upon two sisters who had lost their mother. One broke down, at once, and could not control her grief. After the grief had expended itself she rapidly grew cheerful and liked to talk about her mother. The other sister shed no tears, but went about the necessary duties, and only after about a week did her

grief find expression. Then she broke down and was ill for several weeks. Another example almost identical in nature is reported.

In regard to such differences, it is likely that in the first case the emotional nature was relatively lighter and the expression of grief less intense. In the second a greater physical vigor withstood for a longer time the outbreak. Where there is already nervous weakness it is likely that the cry point is more readily reached; the accumulation is not so great, and the exhaustion therefore relatively less.

Summary of Part II. Both in its aspects as observed by those who have answered the questionnaire and viewed as a physiological process, crying is a very complex phenomenon. Its description and explanation is necessarily difficult. Still the cry presents itself as a somewhat uniform series of acts, though with very decided changes in form due to age and possibly other conditions.

Briefly stated the essential elements of crying are changes in circulation of a very widespread and general kind, characteristic body attitudes, lump in the throat, vocalization, sobs and tears. The attitude of body varies with the cause of the cry; the typical attitude of the grief cry is one of collapse. The attitudes of grief in ceremonials further illustrate this point and bring out the fact that crying is closely related to actions of abasement and self-torture, renunciation and even suicide.

Vocalization in the cry comes early in the series of acts and it is the first feature of the cry to attract attention in the life of the individual. There is also more vocalization among primitive races than among the civilized. It is from the "cry" as call for help, which is clearly its function in the cry of anger, fear and hunger, that language has in part, at least, developed.

The lump in the throat is a mysterious element. It appears to precede the tears in the cry and to be related closely to the beginning of the sob. Connected both with swallowing and breathing, its function seems to connect it both with the mechanisms of respiration and digestion.

The sob is, for the most part, a late symptom of the cry; it begins, though there are exceptions to this rule, later than the other symptoms and remains after they are suppressed. It is absent in the young child, and there are but few references to it in the ethnological literature. It appears to belong especially to deep grief and, typically, to adult grief. Like the lump, it is connected both with respiration and movements different from those of respiration. It usually comes as a climax to the crying spell.

Tears are absent during the first few weeks of life save in exceptional cases. They are, of all the elements of the cry, the

least under control of the will. And, although the evidence on the point is not conclusive, there appears to be more shedding of tears in the young child and among primitive peoples. The cries of anger, fear and hunger of the young child are relatively tearless; it is the grief cry that is essentially the tearful cry.

The effect of crying is declared good, both by the observers who have reported, and by medical opinion. The good effect is felt in a mental rather than a physical relief, since the physical result is commonly exhaustion. Some medical opinion supports the view that crying is a helpful stimulation in the young child and that the cry resulting from grief aids a sluggish circulation and also affords some kind of a relief from a tension or overcharged condition of the nerves.

There are two groups of symptoms or elements in the cry. The first group develops earlier and belongs more especially to the cries of hunger, pain, fear, anger; it has more vocalization and less tears. The deep inspirations and holding of the breath go with this but there appears to be very little or no sobbing. Unfortunately there is little evidence in regard to the facial movements accompanying this cry. All of this complex comprises the cry that is a call for help. It is more active than the second form. The second complex of symptoms comprises the sob, the lump in the throat, the collapsed position, the lack of vocalization and abundant tears. It is passive and goes especially with the hopeless state of mind. The two forms surely overlap in the life of the individual and the symptoms of the two become mixed. The tears and the deep inspiration, especially, appear to accompany both phases of the cry.

These two forms of the cry are not to be thought of as entirely separate but rather as representing, probably, different forms of physical reaction or expression at different moments of a situation, which is characterized by helplessness and a lack of individual adaptation to situations.

It remains now to examine the crying situation more minutely, with special reference to any theories that have been proposed, to explain the movements that occur in it. We shall find ourselves confronted with a mass of interpretation of these acts, which can best be called the physiological or mechanical. Whether the crying acts have any further significance, as coordinated or adaptive acts, can be decided only after a more exhaustive search into the origin and function of the structures that are involved in crying than has yet been made by any one.

III. Theories and Interpratation of Data.

This section consists of (I) a résumé of views in regard to crying. (II) A study of crying as a physiological act. The

elements of the process as they appear to introspection and observation are each treated under three heads (a) anatomical, including especially a description of the nervous mechanism involved; (b) embryological; the genesis of the structures in the human individual; (c) zoölogical; a study of the development of the structures in the race. With such evidence at hand the theories of crying can more intelligently be estimated. (III) the construction of an interpretation of the crying act as a whole.

(I) *The Theories.* The scattered facts and theories about crying relate for the most part to two aspects of the process. (I) its usefulness, as a large physiological reaction of some kind either to stimulate the circulatory mechanism when it is depleted by grief, to revive the metabolic process, or to relieve the overcharged nervous system. These explanations, which account for the fact that crying has survived, are thought sufficient as a theory. They include references to the good effect of crying in the young child as exercise and to the use of tears or the acts that accompany the shedding of tears. These views can be called physiological or mechanical theories of crying. The second group of suggestions relate to the development and preservation of the crying act as language, *i. e.*, a means of expression of need.

The mechanical theory of crying can be expressed as follows: When in a stage of passive grief the victim is in a state of apathy and collapse, with sluggish circulation and slow vital processes, the depressed state is relieved in one of two ways; the consoling friend is likely to interrupt and urge the sufferer to voluntary exertion and to divert the trend of thought into new channels. If the effort is effective, the fatigued cortical centres obtain rest and nutrition is increased through the improved respiration and circulation that has been brought about by the action. (7, pp. 79-80). But when the sufferer is left to himself, unpleasant trains of associations are followed up, the depressed feeling is increased by them and, in return, reacts upon them, the energy becoming lower and lower until there is an outbreak in a nerve storm of weeping. When the shock of grief is sudden we have the same series of events foreshortened. The natural tendency is to hold the breath; there is a disturbance of the heart and stagnation of the vital functions. The weakness of the knees and the prostrate attitude are signs of the bodily weakness. Now but a small stimulus is sufficient to upset the mental and nervous equilibrium already strained. In either case, in the midst of the voluntary cessation of activity and function, nature takes the case into her own hands and produces the same physiological effect to restore and to re-stimulate the action.

For an explanation of tears we are largely indebted to Darwin whose theory is briefly this. During any violent expiration, as in screaming, the external, the intra-ocular, and the retro-ocular vessels of the eye are affected in two ways (1) by an increased pressure of blood in the arteries, (2) by the return of blood being impeded. It is certain that both the arteries and the veins of the eye are more or less distended during violent expiration. Now nature has taken precaution against injury to the delicate structures of the eye: to prevent the eye becoming gorged with blood, the eyelid is spasmodically contracted and holds it tightly against the cushion of the socket thus preventing an undue expansion of the capillaries of the eyeball and those immediately surrounding it. This movement involves a raising of the inner ends of the eyebrows, which occurs simultaneously with the downward and outward movement of the corners of the mouth, that gives the typical expression of the crying face. (7, p. 147.) "Wrinkled forehead, with eyebrows drawn together, closed eyes, up-drawn nose, and open mouth" is a description of a crying child in our returns. The constant and energetic movements of the face are often seen in the cases of hypochondriacs and melancholics. (7, p. 185.)

Darwin adds that "it is an important fact to be considered in any theory of the secretion of tears, from the mind being affected, that whenever the muscles about the eye are strongly and involuntarily contracted, in order to compress the blood vessels, thus to protect the eyes, tears are secreted often in sufficient abundance to roll down the cheeks. This occurs under the most opposite emotions, and under no emotion at all—the sole exception being in the infant, who does not shed tears until from the second to the fourth month." (7, p. 163.)

The overflow theory of the expression of crying is related to the play theories of Spencer and Schiller (42, 39). This view is, that when there is a condition of highly charged nervous structure or over-nourished cells, discharge in the line of the least resistance tends to take place. Such spreading of energy is made to account for much of the action such as occurs in crying and laughing. Those writers who have been influenced by this theory have, as for example, Sully, been prone to see a very close relationship between laughing and crying. Sully gives examples in which the laugh and the cry occur in connection with the wrong stimulus, *e. g.*, a shock of unpleasant news will produce laughter and the reverse—and this is not a pathological but a very common phenomenon. The laugh that follows after a strain of dignified behavior, the nervous cry after a shock of fear or after close attention or prolonged grief, shows that the laugh is a result of a relaxation from a tense

surcharged condition of the nervous system. When the demand for tension is relaxed there is a dispersion of energy and the laugh takes place. The cry is also preceded by a state of tension; and their difference, according to this view, is largely a matter of difference in the manner in which the release takes place. In the case of the laugh there is an interruption; in the case of the cry the tension increases until resistance is overcome.

Close resemblance in the vocalization of the laugh and the cry has been pointed out, and the fact that oftentimes the two are not distinguishable by their vocal expression alone. Textbooks of physiology often call attention to the resemblance of the laugh and the cry, pointing out that the chief difference is in the facial expression, and that the physiological events are very similar. Similarity is again attested by the fact that the laugh is often accompanied by a flow of tears.

Such a likeness is very well explained by the overflow theory, for the laugh and the cry are most similar at the point of greatest intensity. According to the laws of spreading of reflex action, when the stimulus is intense enough, structures are brought into play in a regular order and, at sufficient degree of intensity, the physiological expression of emotions are similar. Hence the ease of the transition from the laugh to the cry. As Sully says, "The extremes of boisterous mirth and grief seem to approach each other." Darwin explains the ease of the transition and the close similarity of the laugh and the cry, by the close similarity of the spasmodic movements." (7, p. 208.) "When the motor centres are engaged in the full swing of one mode of action they may readily pass to the other and partially similar action." (44, a, p. 70.)

It is unquestionable that there is truth in the views in regard to the overflow of nervous energy or stimulation, when action is intense. This fact serves to confuse emotional expression, and doubtless crying both as shedding of tears, and as a larger physiological reaction occurs purely as a result of mechanical stimulation, or spreading of effect of stimulation. But it is very doubtful whether this theory will explain all of the crying reaction or the essential differences and likenesses in crying and laughing.

The experiments of Dumas (8) upon the physiological accompaniments of joy and sadness, and his interpretation of them, make an important contribution to the subject of crying.

Dumas found both in joy and in sadness an active and a passive stage, quite distinct in character from each other. In grief the excited or resistant stage is one of over excitation, increased heart-beat and respiration, and vasomotor constric-

tions leading, on account of the intense effort which it demands of the organism, to a period of fatigue or sadness. The passive stage has opposite physiological characteristics; it is a state of cessatlon of struggle against the situation. The two states commonly alternate.

The tears, according to Dumas, belong to the excited stage of sorrow in which there is active cardiac excitation and peripheral *vaso-dilatation* and not as Lange maintains to a period of reaction or relief from vasomotor contraction. The tears go with red face, swollen eyelids, etc., and other signs of active secretions, urine, etc., the results of circular hyperactivity and vaso-dilatation.

He agrees with Descartes in saying that extreme sadness is the sadness that yields, the less profound sadness that which resists.

This "resistant" theory of the phenomena of crying is important, and is in accord with the view developed later in this paper, in which attempt is made to interpret biologically the body activities in crying, though it must be noticed that the "resistance" in the active stage is non-adaptive, both in its mental and physical aspects, and needs more explanation than it in itself affords, of the crying situation.

Another view of crying is developed from the nature of the cry as a call or expression of a need. This is best stated by Powell. "Those naturalists who are also psychologists explain the origin of weeping in irritation in which the eyes are subjected to smoke, dust, or other foreign particles, and from scratches and blows. Primitive man seized upon this natural effect of discomfort to artificially produce weeping in order that he might express grief to others (34: CXLII). When used at first it was difficult, but it speedily became easy, and becoming easy it gradually became habitual, and finally instinctive by inheritance. Thus weeping became a linguistic sign . . . like other signs of emotion it may be used in the practice of deception. Similarly the sob has originated in the practice to simulate movements of pain and as in the case of tears, "habit has made it instinctive, but its true nature as an artificial sign is plainly exhibited when sobbing is simulated" (34: CXLI).

Inadequate as this theory is to explain the origin of crying, it serves the purpose of emphasizing the manner in which the cry has been built upon and complicated by being turned in many ways from its course. It is quite true, as Powell says, that "emotional signs are especially characterized by multifarious meanings, for this reason emotional language is highly ambiguous, and a ready tool for deception (34, c). But it is not so certain that the symbolic nature of crying is illustrated by its use in various forms of crying for effect. Crying, how-

ever, as the returns to the questionnaire show, does undergo a high development as conscious expression. Many report its use habitually as a tool of deception; it is often accompanied by imaginative dramas of self pity, etc., quite remote from its natural ideationless expression.

Chamberlain has pointed out the significance of the cry in relation to the development of language, and that language has a large root in the cry. There are two language elements, in fact, in the animal cry, (1) the spontaneous reflex cry of emotion, (2) the significance of the interjection, the cry of warning, threat or summons, and the great variety of meaning, which is possible to a single verbal symbol by a mere variation in its tone. By means of stress, reduplication, and intonation, language has been developed (4 b. pp. 118-119). Whatever the natural basis of the cry, it is still more highly conventionalized in the mourning customs of primitive and civilized peoples. Here the form of expression rather than the emotion itself is built upon, and art develops out of sorrow, diffusing the feeling and subordinating it to the consciousness of the expression. Music, too, has one of its roots in the cry, which develops through the rhythmical lamentation and the simple dirge into more complex forms.

Wundt rejects this explanation (*i. e.*, Darwin's) seeing in the lachrymal glands derivative pain assuaging organs. The secretion, which is continuous, cleanses the eye from foreign bodies, such as dust and insects, etc. As the visual images are the most important of all, the shedding of tears would be an unconscious effort to drive away sad representations, having for its foundation an analogy between the painful sensations and the images. (48.)

Ribot comments unfavorably upon this view as well as upon those of other writers. He calls attention to the fact that all attempts to account for tears are based upon their connection with painful states of consciousness. But tears are produced under conditions so varied that this is not adequate. Ribot maintains that the fundamental fact of the physiology of tears is that they are always accompanied by an increase in the circulation, but that this simplicity of mechanism is not incompatible with a diversity of causes. The circulation is accelerated in joy and tears flow as a result of the increased blood pressure. Sorrow is accompanied by a lowering of blood pressure, and in the early stages of crying there is often no shedding of tears. But in the case of sorrow the shedding of tears may well belong to a second stage in which the return of vitality has begun. Now the tears act as a "safety-valve."

That there should be so many divergent and unrelated opinions in the matter by such authorities as Wundt, Ribot, and Darwin indicates, at least, the difficulty of the subject.

Before these theories can be properly judged it is necessary to examine more closely the mechanisms of the act of crying according to the outline proposed above (p. 188).

Physiological and biological data. The lachrymal apparatus consists of the gland, the canals, sac, ducts and nasal duct. Genetically, lachrymal glands first appear in the amniota but the duct first appears in the amphibia. In its embryological development the lachrymal gland arises as a solid growth from the conjunctiva.

Of all the phenomena of crying, the tear is perhaps the most puzzling because it appears under such diverse conditions, physiological and mental. The direct control of the gland is by way of the ophthalmic branch of the fifth nerve, a branch that is also closely connected with the nose, mouth, throat, and respiratory organs. Tears can be directly produced in many ways, such as by stimulation of the conjunctiva, the nasal mucous membrane, the tongue or the anterior part of the mouth; also by powerful stimulation of the retina by light, electrical stimulus, stimulation of the cranial or upper spinal afferent nerves. Venous congestion of the blood will also cause tears. Stimulation of the upper cervical sympathetic is also said to cause a "turbid flow of tears;" but this is a point upon which all are not agreed." (9, p. 1312.)

Darwin's view, supported more or less by the common physiological facts, is that the closing of the eye, or contraction of the orbicular muscle, while causing an undue pressure upon the eye, excites the peripheral nerves, leading to the lachrymal centre. Added stimulation to this centre also occurs as a result of increased circulation of the blood. When the surface of the eye is bruised or irritated tears flow freely. Remote acts, such as coughing, sneezing, laughing, vomiting, all of which involve similar effects upon the circulation and respiration, will produce a flow of tears.

These facts all taken together indicate that no single certain explanation can be made to account for the tear. The mechanisms involved are so interrelated and physiological and mechanical factors so combined that the connection between the tear and a central cause, such as grief, cannot be surely determined. The question is still open, however, whether any mechanical cause alone is sufficient to account for the *large* flow of tears which sometimes occurs in connection with a *very slight* emotional disturbance in which the apparent stimulation of related mechanisms is small and in which there is probably no strong congestion or spreading of stimulus through overstimulation.

The facial movements receive little attention in the returns and the physiology of them can go little beyond referring them

to action of the facial nerve which is concerned in all facial expression, and the further fact that the vagus is also concerned in facial contortions.

The lump in the throat is also obscure as a physiological event. In certain analogous acts there is affection of the throat which may throw light upon the lump. In the globus hystericus the subjective event is that of a constriction of the throat or strangulation. It usually begins with a painful feeling which arises in the lower part of the abdomen, and which mounts upwards until it reaches the neck and then gives a feeling of strangulation. Peterson says that the condition which exists is a "pharyngeal spasm" (5 a). In vomiting, the throat undergoes a change very similar to that described in crying. Here the act is clearly purposive, namely to prevent food from passing backward into the trachea. The larynx rises,—the epiglottis is pulled down to close the entrance to the trachea and the soft palate rises to close the entrance into the nasal passages. The result is a temporary strangulation, respiration stops. A similar act takes place in hiccough, the epiglottis closing the entrance to the trachea.

In connection with the act of crying, attention was called to another phenomenon also referred to the throat, several report as the most important and persistent physical accompaniment of grief or slight effect of a pathetic incident, a pain or discomfort in the throat. This may occur when there is apparently no other sign recognized. Pain in the throat persisted for a year, in the case of a woman who grieved at the death of a child. The suggestion, in a case individually reported, that these are felt to be sometimes an effect of the thyroid, led to a further examination of the point.

There is considerable evidence to show that the thyroid, when enlarged in the condition of goitre, quickly shows the effect of grief and all mental excitement. One case was reported in which the goitre grew largely during any continued mental excitement. Among the chief causes of goitre are mentioned mental and emotional shocks, "especially profound and protracted anxiety and grief." (5, p. 498.)

A brief review of the anatomical facts of the thyroid may throw a little light upon the problem of crying. The organ is highly vascular, its nervous control is by way of the middle and lower ganglia of the cervical sympathetic and through the vagus. Embryologically it is developed in vertebrates as a ventral diverticulum of the mouth or from the pharyngeal epithelium. (38.)

Phylogenetically the ventral portion of the primitive pharynx was concerned in the transmission of food. The special mechanism of this was effected by what was afterward to be-

come the median element in the thyroid. It is suggested that this change of function was correlated with the increasing size of the primitive chordata, and consequently the ability to eat larger prey. The larger food would not have the tendency to escape through the gill slits, and would not need any assistance to pass into the œsophagus. (13, p. 172.) The very close but still imperfectly understood relationship between the thyroid gland and the nutritive processes of the higher animals also adds evidence to its primarily digestive function.

Another effect of crying that is to be referred to glandular changes is the increased salivation; which is, especially in children, sometimes very pronounced, partly accounting for the tendency to swallow repeatedly when crying. The salivary glands are controlled by the facial nerve and also by the sympathetics. The secretion varies with the nature of the nerve stimulation. The saliva obtained by stimulating the chorda tympani nerve is thinner and less viscid than the so-called sympathetic saliva, which is remarkable for its viscidity (9, p. 307).

The sob is a complex muscular act, a combination of a downward pressure of the diaphragm, rhythmically performed, and accompanying actions of the abdominal muscles. It differs from ordinary deep breathing, as one may determine for himself by performing the motion, in that the abdominal movement typical of the sob is in the direction of a constriction and that it is an expiratory movement. The jerkiness is accounted for by the fact that the inspiratory movement thus works against contraction in the direction of an opposition. It may be noted here that the diaphragm belongs to two physiological systems, the digestive and the respiratory, a fact which is illustrated by the part it takes in hiccoughs and in vomiting—acts which need a closer scrutiny with reference to our present topic. There is some doubt whether vomiting is due partially to the contraction of the stomach walls themselves or movements of the diaphragm and abdominal walls only. The event consists of nausea, a reflex flow of saliva and retching movements, which consist principally of spasmodic inspirations with closed glottis. The effect of these movements is to compress the stomach by the descent of the diaphragm and the contraction of the abdominal walls. It is not shown that there are any anti-peristaltic movements. The causes of vomiting are very numerous, including stimulation of the vagus of one sort and another. The afferent nerves concerned in the act are the sensory fibres of the vagus; the afferent are the vagus, the phrenic, and spinal nerves supplying the abdominal muscles. Though the common cause is stimulation of afferent nerves by the contents of the stomach, the vomiting act is very easily produced by remote reflex causes and by emotions—especially fear and grief. The

effect of grief upon the digestion may also be mentioned here. (20, p. 326.) The essential point is that vomiting is a "spasmodic contraction of expiratory abdominal muscles and inspiratory diaphragmatic muscles." (20, pp. 325-326.)

Hiccough is caused by a twitch of the diaphragm attended by a sudden closure of the glottis, and is most frequently caused by gastric irritation. It usually results from an excitement of the phrenic nerve; but it is also associated with respiratory centres, a laryngeal spasm and inspiratory movements. It attends certain forms of hysteria. While conversely nausea and hiccough are often characterized by symptoms attending globus hystericus, which is described as a painful feeling arising in the lower parts of the abdomen and developing into the sensation of a round body which mounts upwards—causing a feeling of strangulation in the throat. (5, p. 585.)

In both these acts, the mechanisms both of respiration and the digestive apparatus are brought into play. It must be remembered that the action of the stomach itself as a part of the digestive system is largely autonomous. It is an automatic organ and the stimulation comes from the contents of the stomach. The two vagi and the solar plexus are however connected with the stomach-œsophagus-movements (20, p. 312).

The close resemblance of the sob to these digestive movements cannot be overlooked. The movement of the sob and the vomiting movement are alike in every particular except the apparently accompanying movement of the stomach itself in the movement of vomiting or the internal stimulation from the contents of the stomach. The throat phenomena occur in all of these physiological acts and all are influenced by depressive emotional causes. One-third of the responses to the question whether nausea is an attendant symptom of the cry were affirmative in nature.

All of these movements are results of combinations of mechanisms that belong both to the digestive and respiratory system. The manner in which this close relation has been preserved is easily understood if one recalls the fact that the respiratory mechanism is an outgrowth of the digestive system. Embryologically the lungs develop like a gland out of the œsophagus, at least in all amniotic vertebrates (17). Physiologically the two functions are interacting, both in that they make use of the same motor mechanisms *and in other ways*. The breathing rate is affected by the glosso-pharyngeal nerve, especially in the act of swallowing (11, p. 738). Strong stimulation of the olfactory nerves and fibres of the fifth nerve distributed to the nasal chambers will cause expiration. The glosso-pharyngeal acts with the pneumogastric as the afferent nerves

of respiration. Through the pneumogastric nerve various effects become common to the two systems (20, p. 563).

Interpretation of the crying act as a whole. Do such facts as the above afford any means of interpreting the action of crying? On the one hand there is the fact that the vagus nerve controls or may control the greater part of all the actions that occur in crying. The vagus affects the salivary glands and the thyroid, exerts an influence upon the circulation and causes the globus hystericus as a pharyngeal spasm. It mediates movements and sensations of the œsophagus, movements of the stomach and organs of voice; it tightens the vocal cords, opens and closes the glottis, controls abdominal muscles, the sensations and movements of respiration and the contortions of the face. Two sets of movements, the tear act itself and the facial movements are, in part at least, mediated by other nerves, the movements of the face by the seventh, and the tears by the fifth cranial nerve; the vagus is closely connected with the facial nerve. But the whole nervous connection of these acts is so complicated that no certain interpretation can be made on the grounds of anatomical relationship alone. Even though one should maintain that the whole act of crying is a mere overflow of stimulation and entirely the result of action of the vagus nerve, it must still be asked why of all the combinations that can be affected by the vagus nerve should just this particular set of movements accompany the state of grief.

It remains to ask whether there is any functional connection between the various cry acts. The closest similarity was found between the sobbing act and the act of vomiting; this included similarity of the movements of the diaphragm, the throat phenomena, in part at least and the affection of glands, including tears. That this resemblance is more than a fortuitous one cannot be proved by anatomical evidence alone, and must, in any case, rest upon circumstantial evidence. But there is other proof that this is not a mere accidental resemblance.

If the acts of crying and laughing are considered together it will be noticed that there are here not only phenomena of a peculiar kind, but the antithesis in several important ways of the two will be evident. Obviously the crying act and the laugh accompany typically mutually exclusive and opposite states. The laugh is largely an expiratory act, the cry, that is the typical adult cry, with the sob is an inspiratory act. The muscular movements in the case of the laugh are felt to be of the lower abdominal muscles and are different in character from the sobbing movements, though both are rhythmical. The laughing movement is performed by a bracing of the diaphragm and, at the same time, a rhythmic contraction of the

walls of the abdomen so that the diaphragm is gradually forced upward. The movement of the sob, as has been said above, is a forcing downward of the diaphragm with, at the same time, an action of the upper abdominal muscles acting in an upward direction. The facial movements are also opposite. In the laugh the face is as it were pulled together; the corners of the mouth are pulled upward and the eyebrows are brought downward. In the cry the eyebrows are lifted and the mouth is pulled downward. Another well known effect of the laugh upon the lower abdominal mechanisms, namely the relaxation of the sphincters, is to be compared with the effects upon the glandular appendages that occur in crying.

The circulatory differences are not so certainly determined but, in laughter, there is an increased circulation, dilatation of blood vessels, increased muscular movement and the effect upon digestion is beneficial. The opposite conditions accompany grief.

All of these facts put together establish a strong probability of the close connection of the acts of laughing and crying with the movements that are connected with the digestive system—that laughing is the accompaniment of movements that promote digestion and that crying is a part of the process which is involved in the act of rejection of food. This hypothesis receives support from so many sources that it can scarcely be disregarded. The sobbing act itself, with its throat accompaniment similar to the acts of vomiting, the effects of glandular structure are all parts of the digestive movements of one kind or another. The apparent part played by the thyroid is also strongly corroborative of this view. Its close connection with the digestive system phylogenetically suggests that it is directly affected by nervous stimulation. If we accord any credit to the view that emotional expression often involves structures and functions that are at the present time in a state of disuse in the human, the direct effect of the thyroid both as a secretory organ and as a mechanism connected with the movement of food in the alimentary canal would be expected. The further effect of such an action upon the shedding of tears is confirmed by the connection between affections of the thyroid and disturbance of the eye seen in exophthalmic goitre.

Two views have now been exploited one of which explains the act of crying as a whole, as in itself a meaningless physiological act, and the view supported in this paper, which seeks to interpret the series of movements as a connected function. That this latter view is in keeping with the whole tendency of thinking in regard to the expression of the emotions since Darwin's time will probably be admitted by every one. The views in regard to play represented by Groos are in point as con-

trasted with the older Spencer-Schiller overflow theory, namely that play-actions are co-ordinations of an instinctive character serving ends in the life of the individual.

Many other examples of tendency in the direction of the instinct theory of emotional expression could be given, each one of which strengthens the evidence.

Now, it is necessary to take into account all of the partial conclusions that have been reached in order to see more clearly the place of the crying state among the psychological functions. The physiological events of the cry considered as call in a state of helplessness, as it is seen in the young child (the cry in which the deep inspiration and strong vocalization are the distinguishing features), soon becomes complicated with the phenomena that have been called rejection movements and which are apparently connected with the digestive system. These symptoms, belonging purely to the collapsed stage of the crying state, combine at many points with the call cry. The movements may to a certain extent antagonize each other, as when the effort to call is maintained against the collapse tendency of the nervous system. That the long inspirations of the cry are associated with the effort to cry aloud in order to obtain assistance can hardly be doubted. And there may be in the peculiar inspiratory movements certain useful acts apart from this motive, such as gaining vocal power and at the same time maintaining a firm contraction of the abdominal muscles which is necessary for preparation for strong action. The deep inspiration without this additional effort is one in which the abdominal muscles are relaxed or drawn outward. Similar actions are shown in the practice of girding the abdomen for strong muscular effort, as is sometimes done by athletes.

Thus there are two distinct elements in the physical actions of crying separate in their motive but taking place within the one psychological act followed by collapse or cessation of effort. The call cry with its deep inspiration and strongly active aspect gives way to the hopeless cry which is passive, a breakdown accompanied by body prostration, sobs, tears, lamentations, self-torture, and physiological movements of "rejection." It would be difficult to imagine a combination more clearly representing the giving up of the struggle of adjustment to environment and helplessness. The fear, hunger, and anger cry are all essentially cries for help. The adult does not, as a rule, cry for help, but he helps himself through this stage and then, at the end, breaks down, when the schism between the need and the energy becomes too wide. So that it is quite readily explained why the breakdown form of crying goes only with a high degree of nervous development. Under conditions of tense effort the nervous system repudiates the imposition that

is put upon it, breaks through the will and throws to the winds all the accumulation of adaptive machinery and hereditary precautions. The individual throws himself without restraint upon his environment. Like its opposite, laughter, then, crying is essentially non-adaptive in its character. It lacks the incisive character of the *common* instinctive reactions. It is diffused, and unco-ordinated and the movements that are most characteristic of it are not adapted to any immediate end. How shall we interpret such action on the hypothesis of the survival of the fittest among the psychophysical functions. Possibly it can be interpreted as Mosso understands fear, a flaw in the organism. Possibly its usefulness as a restorative of equilibrium in the body or to relieve the nervous tension is quite enough to assure it a place among the functions which have survived. But there is another element, that is, its social significance. The purpose of the cry as call is social; it demands and assumes the co-operation and good will of kind. The hopeless cry also stands for a condition which also calls for some form of relief. The crying act is therefore a psychosocial situation and both the call cry and the cry of despair have come to have a social significance. It is the reverse of the objective side of the act of helpfulness which lies at the bottom of social development. Therefore the ability to cry stands primarily for need, and not for any moral state of the crier. To express his need the infant and the young child are over-expressive. The cry in its effect upon the parent and nurse is an imperative demand quite out of proportion to the actual distress and out of proportion nowadays to the danger of neglect. But under stimulus of instinct the child unconsciously simulates physical pain and severe suffering. The gasp and the prostrate position of the cry of the adult are also extravagant and over-expressive. It simulates or stands for a total giving up and, in itself, in some respects, resembles the actions of dying. The modified cry of civilized man, therefore, stands for this greater event and the elicitation of sympathy, so notoriously accomplished by the mere suffusing of the eyes with tears, is symbolic of the greater need and derived from it. The deep hold that this act has upon the social sympathies is surprising when one understands how much out of proportion to need and even moral deserts it is. Another factor has, of course, assisted in the reduction of the cry and the emphasis of the tear as its symbol, namely, the tendency for all emotional expression to become centered in the face. For with the advent of clothing, the race has come more to "live in its face."

The theory of the cry that is based upon its usefulness physiologically is in the light of this interpretation inadequate; it

reaches to very little depth. Like other actions of an instinctive character crying aims at its mark without special reference to the immediate effect upon the physiological actions of the organisms. Just as we flee in the presence of danger at the risk of our hearts and cerebral arteries, so we cry even at the expense of our nervous energy. The compensation is in the provision that is made for the removal of the particular trouble toward which the instinctive action is directed and the social aid that is commanded. In other regards the body takes a chance. The crier gets his mental relief, and doubtless the body for the most part is not especially benefited by the act.

The acts of crying are, thus, by no means a mere symbol of the act of giving up the struggle. The movements in themselves have significance and are a means towards an end. They are physiologically cessation and even reversal of the will to live and be nourished.

If the question arise as to how these particular movements may have gotten associated with the particular mental states that they accompany, the answer must be because they have never been dissociated from it. Dislike expressed in movements of rejection or withdrawal is the most primitive displeasure: when displeasure is intense it brings to light the movements that are naturally a part of it and which, it is quite possible, are present in the small in all expressions of displeasure. We have learned from recent psychologists to associate non-assimilative states and actions with states of displeasure, and these cry acts are simply these writ large.

If this argument is justified, it is evident that there is in the cry act a very primitive form of emotional expression or physical correlate of the mental event of displeasure. The peculiar non-adaptive nature and diffusive character of the body effects in crying are set apart from the ordinary emotional reactions and we can suppose that it strikes deeper into the organic life than they. In a word, crying is an expression on this interpretation of displeasure in its most generic form.

The social aspect of the cry is so clearly illustrated in the typical early grief cry of the child that its significance can hardly be missed. The child turns his back and covers his face to cry, or throws himself upon the floor, an evidence of the cessation of appeal or effort to obtain something, but social aid is thereby profoundly stimulated and the physiological acts signifying cessation of appeal have come to be more effective than the effort acts themselves.

Summary of the Psychology of Crying. Crying, though an exceedingly interesting and fundamental topic in expression of the emotions, has been a neglected problem. The present approach to it includes the interpretation of from several sources

(1) Returns from a questionnaire, (2) data from ethnological material, (3) physiological data, (4) the scattered literature upon the subject.

Crying occurs under many different mental and physical conditions, but its essential element, psychologically, proves to be a feeling of helplessness in the infant shading into a feeling of hopelessness and surrender of effort in the typical adult cry. The important conclusion is that crying in its last analysis is a situation in which a reaction has taken place at the end of a period of stress in which there has been strong effort and depleted nervous energy. It is essentially a breakdown of the nature of a cessation of adaptation to environmental conditions. An analysis of the crying act itself into its component physiological parts shows the following to be the most important traits: disturbances of the circulation, body attitudes, sobs, tears, lump in the throat and vocalization. There are clearly two groups of symptoms that accompany different moments in the crying act. The first group are the active movements of call, as represented by the vocalization of the young child. The second group, including the facial expression, the sob, the lump in the throat, the tears, prove to be closely associated with movements of the digestive apparatus, and are interpreted as "rejection" movements, going back to the primitive form of rejection of food. The theories that explain crying merely as an "overflow" of energy or as inherited habit seem inadequate. By studying the actions of laughing and crying in relation to each other, still further evidence is obtained for the "rejection" theory.

These movements are, according to this interpretation, a primitive form of expression on the physical side of the mental state of displeasure. The mental and the physical act having never been dissociated from each other, the suggestion is made that, in more subdued form, some such actions occur as the correlate of all states of displeasure. The particular form of expression of helplessness by the cry has been preserved together with its subjective correlate, pity, as a fundamental psycho-social situation.

Reference.

1. Bachofen, J. J. Das Mutterrecht; Eine Untersuchung über die Gynaikokratie der alten Welt nach ihrer religösen und rechtlichen Natur. Stuttgart, 1861. p 385.
2. Balfour, F. M. A Treatise on Comparative Embryology. London, 1885. 2nd ed.
3. Bourne, Gilbert C. An introduction to the Study of Comparative Anatomy of Animals. London, 1900-02. Bell's Science Series.
4. Chamberlain, Alex. F. a. The Child and Childhood in Folk Thought. New York, 1896.

CHAMBERLAIN, ALEX F. b. The Child; A Study in the Evolution of Man. London 1903. pp. 119-121.

5. CHURCH, ARCHIBALD AND PETERSON, FREDERICK. Nervous and Mental Diseases. Philadelphia, 1903, 4th ed.
6. COWLES, EDWARD. a. Neurasthenia and its Mental Symptoms. (Shattuck Lecture.) Boston, 1891.
—— ——. b. Mental Symptoms of Fatigue. New York, 1893.
7. DARWIN, CHARLES. Expression of the Emotions in Man and Animals. New York, 1873.
8. DUMAS, G. Recherches experimentales sur la joie et la tristesse. Revue Philosophique. Paris, 1896, 41:577; 42:24, 113.
9. FOSTER, M. A Text-book of Physiology. New York, 1891, 6th ed.
10. GOWERS, WM. RICHARD. Manual of Diseases of the Nervous System. London, 1886.
11. GRAY, HENRY. Anatomy Descriptive and Surgical. Philadelphia, 1887. p. 738.
12. GROOS, KARL. Play of Animals. Tr. by E. L. Baldwin, New York, 1898. Ch. II and V.
13. HADDON, A. C. An Introduction to the Study of Embryology. London. 1887.
14. HALL, G. STANLEY. a. A Study of Anger. *Am. Jour. of Psy.*, July, 1899. 10:516-591.
—— ——. b. and SAUNDERS, F. H. Pity. *Am. Jour. of Psy.*, July, 1900, 2:534-591.
—— ——. c. A Study of Fears. *Am. Jour. of Psy.*, Jan., 1897, 8: 147-249.
—— ——. d. and ALLIN, A. The Psychology of Tickling, Laughing and the Comic. *Am. Jour. of Psy.*, Oct., 1897. 9:1-41.
15. HALL, MRS. WINFIELD S. The First 500 Days of a Child's Life. Child Study Monthly. Chicago. 2:472.
16. HASTINGS, J. A. Dictionary of the Bible. Edinburgh, 1900. pp. 453-4.
17. HERTWIG, W. A. O. Text-book of Embryology of Man and Animal. (Tr. from 3rd Ed. by E. L. Mark.) New York, 1892. p. 320.
18. HOGAN, LOUISE E. A Study of a Child. New York, 1898.
19. HOLT, LUTHER E. The Diseases of Infancy and Childhood. New York, 1897.
20. HOWELL, WM. H., Editor. An American Text-book of Physiology. Philadelphia, 1896.
21. IRONS, D. a. Professor James's Theory of Emotion. Mind, N. S. 1894. 3:77-97.
—— ——. b. The Physical Basis of Emotion. (A Reply.) Mind, N. S., 1895. 4:92-99.
22. JAMES, WM. The Principles of Psychology. New York, 1902. Vol. II, p. 465.
23. KRAEPELIN, EMIL. Lectures on Clinical Psychiatry. (Rev'd Tr. and ed. by Th. Johnstone.) London, 1904.
24. LANDOIS, L. A Text-book of Human Physiology. Tr. from 6th Ger. Ed. by W. Sterling, 3rd ed. London, 1888.
25. LOWDEN, THOMAS S. The First Half Year of an Infant's Life. Worcester, Ohio, 1895. p. 118.
26. MCKENDRICK, JNO. G. A Text-book of Physiology. Vol. II, Glasgow, 1888.
27. MANTEGAZZA, PAUL. Physiologie de la douleur. Paris, 1888.
28. MEAD, G. H. A Theory of Emotions from the Physiological Standpoint. Psychological Review, 2:162.

29. MOONEY, JAMES. Calendar History of the Kiowa Indians. An. Rep. of the Bureau of Am. Ethnol. 1895-96. p. 363.
30. MOORE, KATHLEEN C. The Mental Development of a Child. Psych. Rev. Sup., 1896. Vol. I (3); p. 38.
31. OSLER, WM. The Principles and Practice of Medicine. New York, 1904, 5th ed.
32. PEREZ, BERNARD. The First Three Years of Childhood. Tr. and Ed. by Alice M. Christie with an introduction by James Sully. Chicago, 1885.
33. PREYER, W. The Mind of the Child, Part I. The Senses and Will. Tr. by H. W. Brown. New York, 1888. p. 308.
34. POWELL, J. W. Philology. Report of the Director. An. Rep. of the Bureau of Am. Ethnol., 1898-99.
35. REESE, ALBERT M. An Introduction to Vertebral Embryology, based on the Study of the Frog and the Chick. New York, 1904. p. 49-207.
36. RIBOT, THEODULE, A. The Psychology of the Emotions. London and New York, 1897. p. 236.
37. RICHARDSON, B. W. The Psychology of Tears. In Dictionary of Psychological Medicine. Ed. by Hack Tuke. London, 1892. Vol. 2, 1273-74.
38. ROLLESTON, GEORGE. Forms of Animal Life. 2nd ed. Rev. and Enl. by W. H. Jackson. Oxford, 1888. p. 350.
39. SCHILLER, J. C. F. Werke, 12:1. Ed. by B. Boxberger. Über die Ästhetische Erziehung des Menschen. In einer Reihe von Briefen, siebenundzwanzigster Brief.
40. SHERRINGTON, C. S. Experiments on the Value of Vascular and Visceral Factors for the Genesis of Emotion. Proceedings of the Royal Society of London, 1900. 66:390.
41. SHINN, MILICENT W. A. Notes on the Development of a Child. Berkeley, The University, 1893-1899.
—— ——. b. The Biography of a Baby. Cambridge, 1900. p. 80-81.
42. SPENCER, HERBERT. Principles of Psychology. New York, 1883. 2:627-648.
43. STEVENS, MATILDA C. The Sia. An. Rep. of the Bureau of Am. Ethnol., 1889-90. p. 144.
44. SULLY, JAMES. a. An Essay on Laughter. New York, 1902.
—— ——. b. Studies of Childhood. New York, 1896.
45. TENNYSON, ALFRED. The Princess. Canto Five.
46. TURNER, L. M. Ethnology of the Ungara District, Hudson Bay Territory. An Rep. of the Bureau of Am. Ethnol., 1889-90.
47. WEIL, G. The Bible, the Koran and the Talmud, or Biblical Legends of the Mussulmans. New York, 1846.
48. WUNDT, WILHELM. Grundzüge der Physiologischen Psychologie, 3:287 and 292. Leipzig, 1902-1903.
49. YARROW, H. C. Introduction to the Study of the Mortuary Customs of the North American Indians. Washington, Govt. Print, 1880.

Acknowledgments. In writing this paper, assistance has been received from many sources, for which it is a pleasure to make acknowledgments. President G. Stanley Hall suggested the topic, issued the questionnaire and rendered assistance in many ways. Dr. Theodate L. Smith, Dr. Caroline Osborn, Dr. G. E. Partridge, of Clark University, and Mrs. G. E. Partridge have also assisted in the work. Answers to the questionnaire

were received from Dr. Margaret Smith, State Normal School, New Paltz, N. Y.; Prof. W. S. Monroe, State Normal School, Westfield, Mass.; Miss Alice Torrey Whyte, School of Ethical Culture, New York City; Dr. Norman Triplett, State Normal School, Emporia, Kansas. Much help in securing the ethnological material in regard to the Indians was given by W. H. Holmes, Chief of the Bureau of American Ethnology, Smithsonian Institution, Washington, D. C. Material was received from Dr. S. Weir Mitchell, Miss Alice G. Fletcher, of Washington, D. C., Dr. George Bird Grinnell, Editor of *Forest and Stream*, New York; Mrs. M. C. Stevenson, Mr. James Mooney, Dr. John R. Swanton of the *Bureau of American Ethnology*. Dr. J. G. Merrill, President of Fisk University, Nashville, Tenn., and Dr. W. E. B. Dubois, Atlanta University, furnished data in regard to the negro. Dr. Sidney Gulick, Japan, and Mr. T. Kuma, Clark University, wrote about the Japanese.

Thanks are due also to Mr. Wesley R. Long, Puerto Rico, to Professor N. L. Nelson, Utah, to former Mormon missionaries:—Mr. Francis W. Kirkham, New Zealand, Mr. H. H. Cluff and Mr. Wm. Allen, Hawaiian Islands, Mr. Clair W. Reid and Mr. Edward H. Swash, Samoa, for special reports, and to Dr. Herman T. Lukens, State Normal School, California, Penn., and Madame Anna Grudzinska, Kieb, Russia, for individual answers to questionnaires.

WUNDT'S DOCTRINE OF PSYCHICAL ANALYSIS AND THE PSYCHICAL ELEMENTS, AND SOME RECENT CRITICISM.

II. Feeling and Feeling-Analysis.

By Edmund H. Hollands.

It is important, in order correctly to interpret Wundt's later theory of feeling, that we clearly understand his position on the subject in his two earliest works. That position may, like the theory of perception which it accompanies, be described as epistemological.

In the *Beiträge*, as has already been explained, the pure sensation is the original element, and the perceptional process is a series of unconscious judgments or inferences.[1] As a result of such unconscious judgment, feeling and sensation in the stricter sense are distinguished as respectively the subjective and objective moments in the pure sensation. This distinction is therefore not original, but the result of reflection. It appears only with self-consciousness and the distinction of the self from its objects. To it no real separation in the pure sensation corresponds, but only a tendency of the stimulus rather to produce an objective impression than a feeling of change in the organ of perception, if the sensation is predominantly objective; or the opposite tendency if it be predominantly subjective.[2] The *Vorlesungen* merely amplify this treatment. Sensations and feelings are both based on an unconscious 'logical' process, and the distinction between them is not a distinction in this process, but in the ends to which they are directed. Feeling is directed to an activity of the subject, sensation to the knowledge of objects. Sensations have the end of knowledge; but we not only know objects, we are also attracted or repelled by them. Feelings are, therefore, an essential part of our physical life, and give to it its color. They all refer to an activity or passivity, to some state, of the self. The distinction between feeling and sensation is contemporary with, and due to, that between subject and object.[3]

Here, then, feelings are distinguished from sensations, as the result of an unconscious judgment, in the process of distinction of subject from object. The *psychological* basis of this distinc-

[1] *Beiträge*, 424, 437, etc. [2] *O. c.* 398-400. [3] *Vorl.*, II, 1-5, 15-16.

tion is that the feelings are 'subjective' in character, while the sensations are 'objective.' The *physiological* basis is a peculiarity in the process in the end organ which tends to make it an object of attention for itself, in the case of feeling; or, in that of sensation, to cause it to be comparatively unattended to in the interest aroused rather by the 'objective impressions' which it mediates.[1]

When we come to the first edition of the *Physiologische Psychologie*, the epistemological distinction has disappeared. Wundt renounces it by name, in a passage which reappears in all the succeeding editions until the fifth. Here it is dropped, probably because Wundt felt that his revision of the *Vorlesungen*, with its explicit disclaimer of his earlier theory of perception, was sufficient. It is important that we see clearly what he means to abandon in this passage, and what not. The sentence reads as follows: "I must, finally, point out, as a conception *partly* belonging to the epistemological view (of feeling), that which I myself once advocated, according to which feeling is everywhere based on an unconscious process of inference, by which the change in our inner state aroused by sensations or ideas is defined as *subjective* (Vorlesungen über die Menschen und Thierseele, Bd. 2.)."[2]

According to this, then, the earlier theory of feeling was only in part epistemological, and that which made it so was its appeal to an unconscious judgment discriminating between subject and object. That this is Wundt's meaning is clear from the fact that he still continues, especially in the second and following editions of the *Physiologische Psychologie*, to distinguish feelings and sensations as 'subjective' and 'objective.' The second edition of the *Vorlesungen*, while its preface definitely disclaims all the matter in the first which it has omitted, reproduces all the passages in it which contain this distinction. It appears then that 'subjective' and 'objective' have for Wundt some psychological meaning. They correspond to some introspective distinction, and what that is we must look to their further application to discover.

We find at once a considerable advance in clearness of treatment in passing to the first edition of the *Grundzüge*. The pure sensation is the primitive element, and in it we distinguish intensity, quality, and feeling-tone.[3] But the feeling is not, like the two attributes, an original and independent constituent

[1] This physiological difference is, of course, not a new theory. *Cf.*, *e. g.*, F. D. E. Schleiermacher, *Psychologie*, 63 ff. (ed. by George, *Sämmt. Werke*, VI.)

[2] *Phys. Psych.*, 460; 2nd ed., I, 496; 3d, I, 540; 4th ('partly' omitted), I, 593.

[3] *Phys. Psych.*, 273.

of consciousness. In the first place, it is determined by the intensity and quality of the sensation. In the second, the feeling-tone disappears, when we consider the sensation by itself, without reference to the consciousness into which it enters, while from intensity and quality we cannot abstract without destroying the sensation. Feeling is, then, a third aspect superadded upon sensation in so far as it stands in relation to consciousness; or, it *is* this relation. We call it sense-feeling or feeling-tone. All sensations have some degree of feeling-tone, and those in which it is prominent we call (sensory) feelings, while those which have little of it are called sensations in the narrower sense.[1]

The second edition points out that, while there can be no feeling without sensation, there must be, because of the indifference-zone, some sensations without feeling.[2] (The first, p. 273, admits this only as a theoretical possibility.) Its important advance, however, is in defining *what* conscious relation constitutes feeling.

Feeling is insufficiently defined by referring it to the general state of consciousness, for sensation "in all its constituents must be conceived as a reaction of our consciousness."[3] Quality and intensity, no less than feeling, can be conceived as subjective reactions of consciousness upon certain forms of outer stimulus. The process underlying feeling is therefore not separable from that underlying sensation. It is nearer the truth to say that in the indivisible whole, a sensation of fixed quality, intensity, and feeling-tone, the latter represents *the constituent in the case of which we are not immediately impelled to refer to objective relations of the stimuli.* In reality sensation, while unanalyzable, is not a simple process either physically or psychically. The *mode of apperception* is an inseparable constituent of all the sensations which we can psychologically examine. Accordingly sense-feeling is immediately comprehensible when we think of it as "*the mode of reaction of the apperceptional activity upon the sense-excitation.*" Hence the influence of the general state of mind upon feeling-tone, and the more subjective significance which we give to it, and also its reference to will.[4]

Briefly, then, the theory of the first period holds that there is but one class of elements, sensations. Feeling is a third attribute of most of these, and represents their subjective aspect. More specifically, it corresponds to or is the mode of reaction of attention upon sensational content. The way in which a perception is taken up into consciousness at large determines feeling. Feeling thus depends on the general sub-

[1] *O. c.* 426-427, 273.
[2] *O. c.* I, 272, 465.
[3] *O. c.* I, 466.
[4] *O. c.* I, 491-492.

jective disposition in a way which is not true of quality and intensity. Its poles are pleasantness and unpleasantness.

The only material in the second period which concerns our present problem is found in the two articles, *Ueber psychologische Methoden*, and *Zur Lehre vom Willen*, in the Studien of 1883. In the first, we have merely the indication that there is now for Wundt a problem of feeling-analysis.[1] In the second, quality and intensity of feeling are mentioned for the first time, and its close relation to will is emphasized. Pleasure and pain, in the form of desire and repulsion, govern all volition. Feeling is on the one hand inseparable from sensations and ideas, and on the other it could not exist without a will the tendency of which it manifests.[2] These articles, then, show that Wundt was moving toward the position of the third period, where feeling appears as an independent element.[3]

This position is defended for the first time in the *System der Philosophie*, 1889. Inner experience is, we are here told, a manifold of ideational processes, with which feelings are inseparably connected. We directly relate these feelings, as subjective, to the connected ideas, thought of as objective. Since feelings can never be thought of as *objects*, as the ideas can, it is an unavoidable tendency of the naïve consciousness to make them part of the ideas, especially of those which concern the body and its movements, and finally independent ideas themselves. The ambiguous use of the word *Empfindung* has assisted in this perversion of the facts of inner experience. Modern psychology has restricted the word to the elementary unanalyzable constituents of consciousness, and, in a narrower sense, to the elements of ideas. As such, sensations have intensity and quality as attributes. We also speak of the *feeling-tone* of sensations, by which we imply that every sensation has a relation to our own action and passion. This relation, however inseparable from the sensations, is not objectified along with them, nor does it vary in like measure with their intensity or quality. It therefore cannot, with these, be classed as a third fundamental attribute of sensations. Hence the attempt to reduce all feelings and feeling-complexes to feeling-tone of sensations is invalid, and its absurdity becomes evident as soon as an attempt is made to explain in this way the affective result of such a complex as a work of art.

Immediate experience has, therefore, as its content objective

[1] *Studien* I, 5-6.
[2] *O. c.* 344, 349-350.
[3] As before, the 3d and 4th eds. of the *Phys. Psych.* reproduce the treatment of the 2nd.

ideas and accompanying subjective circumstances. The first task of psychological analysis is, then, to discover the last elements of these two constituents of experience. We may restrict the name *sensations* to the elements of the first, and call the elements of the second *simple feelings*. The separating abstraction is difficult in the case of feeling, because it has not the reference to an object which permits the definite isolation of the idea as an object of attention. Feeling is always attached to some perceptual content, and is particularized only by such a connection. Will, like feeling, always appears in intimate connection with idea and sensation; but the absence of identity between them is established by the fact that the same sensational content may appear without the will, and that a will of the same character may attach itself to an entirely different content.

Simple feelings, like elementary sensations, are "primitive facts of consciousness" not to be derived from anything beyond their immediate presence there.[1]

It follows, then, that the content of consciousness divides into acts of will, feeling, and ideation. The three are never separated. Ideation is objective, feeling is a subjective reaction on the ideas, based on the volitional activity of the subject. Pleasure and pain are its chief directions, corresponding to the chief directions of the will.[2]

Wundt's reasons for separating feeling as an independent element, as they appear in the course of his discussion here, may be put under four heads, which have already been mentioned in another connection. (1) Feeling "is not objectified with" sensation. (2) Experience as a whole has an objective and a subjective side; feelings are the elements of the latter, sensations of the former. (3) The feeling attached to a sensation does not vary in like measure with its intensity or its quality, and is not, therefore, like them an attribute of the sensation. (4) While feeling or will is always attached to *some* sensation or ideational content, the connection is not invariable; the same content may appear without the feeling, or a like feeling may attach itself to a different content.

The last two of these reasons, as was pointed out in the previous paper, amount to *independent variability* in the sense in which it was there defined as the test of an element. The first two contain the same 'objective-subjective' distinction which we found used in the first period. As there, so here, Wundt fails to specify the psychological meaning of this distinction.

The chief directions of feeling are still the pleasant and the unpleasant, and as yet there is no mention of the great variety

[1] Syst. d. Phil., 380-387. [2] *O. c.* 562-565.

of its qualities as compared with those of sensation. It is immediately referred to the will, but this connection is not new, as the will is with Wundt equivalent to apperception or attention.[1]

Concerning the method of feeling-analysis, we find the statement that feeling, since it has no reference to an object, cannot be isolated as an object of attention.[2] It can, however, be particularized by its connection with a sensational substrate. That is to say, this perceptual content can be isolated, and in this way the feeling attached to it may also be separated from the total feeling-content of that moment.

It involves some repetition to reproduce all of Wundt's discussion of the present subject in the article *Zur Lehre von den Gemüthsbewegungen*. But it seems best, at the risk of tedium, to afford the reader every opportunity to examine his terminology in its various contexts.

His primary definition here is, that sensations are the not further analyzable qualitative elements of ideas, in abstraction from the connections in which they always occur, and feeling is the subjective reaction, as pleasure or pain, upon sensation or idea, which expresses our inward relation to the external excitations.[3] The ideas are the objective portion of inner experience. The subjective conditions may be divided into two classes, the feelings and the emotions. The latter cause a noticeable change in the train of ideas. When we abstract in the case of any given emotion from this change, a feeling always remains to which the change was due. The feelings, therefore, must be regarded as the more simple processes. They are essential elements of every emotion, but not every feeling leads to an emotion. The emotion is also connected with concomitant physiological phenomena, which are either absent or very weak in the case of feeling. Feeling is thus the simple element of all emotive processes, as sensation is of all ideational processes,—not further to be defined or analyzed. There is, however, a distinction, in that the conditions of sensation are also sim-

[1] *Cf.* Studien, I, 350 and Logik, 2d ed., II, 2, pp. 164-168.

[2] This is the invariable teaching of Wundt. There is, however, a passage in §12, 4a, of the *Grundriss*, which, as translated at p. 162 of the first English edition, seems to contradict it. Here we are told that under certain conditions "the concentration of the attention upon it can generally make any partial feeling whatever predominant." Comparison of the first German edition at pp. 190-191, however, shows that the 'it' of the English version is ambiguous, while the original is quite clear. The attention is directed upon "den eigenen subjectiven Zustand" (*i. e.*, as the context shows, the sensational substrate of the composite feeling), and "in diesem Falle hat dann zugleich *diese* Richtung der Aufmerksamkeit meist die Eigenschaft, ein beliebiges Partialgefühl zum bevorzugten machen zu können."

[3] *Studien*, VI, 337.

ple, while those of feeling are most varied and intricate. Feeling is determined both by the ideational content and by the whole condition of consciousness. It is, therefore, capable of infinite variation, and because of its indefinability we can describe any particular feeling only by a reference to the psychological conditions of its origin and to its effect upon the ideational process.[1]

Feelings are most intimately associated with the act of apperception. The only justification for our separating them is the fact that they may greatly vary while the effect of apperception upon the ideational content remains the same. The simplicity which we find in feelings, in spite of the complication of their originating conditions, may be referred to the unity of conscious life in the act of apperception.[2]

This article, then, gives us no further explanation of the psychological meaning of objective and subjective. The remark that feeling expresses our inward relation to the external excitation merely points out the problem. All that is new is the insistence upon the infinite variety of feeling, the explanation of this by the fact of its dependence both on perceptual substrate and on total disposition, and the reference of the simplicity of feeling to the unity of apperception.

Neither is anything new to be found in the second edition of the *Vorlesungen*. Its importance in this connection, as we have already remarked, lies in the fact that it reproduces all the 'subjective-objective' passages of the first edition, while decidedly repudiating its epistemologising tendencies.[3] We pass over the fourth edition of the *Physiologische Psychologie* for the same reason.

The article *Ueber psychische Causalität* in the tenth volume of the *Studien* adds nothing to our definitions, but contains a criticism of psychological theories of feeling which seems to show that one meaning in which Wundt uses the term 'subjective' is lack of correlation with any definite physical stimulus. All ideas are more or less intimately connected with *value-determinations*, sensuous, æsthetic, ethical, or intellectual, for which, or for the influence which they exert on the course of mental life, any parallel or analogue on the physical side is lacking. This is because value-predicates are not applicable to physical processes considered apart from the subject. In so far as physical distinctions accompany the psychical here, as in sensuous feelings they demonstrably do, they lack any peculiarity by which one could account for their psychical value. Attempts to explain such feelings by physiological distinctions—for example, the explanation of pleasure as due to

[1] *O. c.* 358-360. [2] *O. c.* 365. [3] *Cf. Vorl.*, 15, 224 ff., 238-239.

the biological value of its stimulus—are only a relegation to the physical side of the value-predicate observed on the psychical.[1] Such an outcome is characteristic of the explanations of materialistic psychology, which all agree in reducing psychical to physiological processes. This reduction may be in the first place to simple sensations, and through them to outer or inner physiological stimuli; or, when the processes are too complicated to admit of this, they may be reduced to *concomitant excitations* (*Miterregungen*) and to physiological nerve-connections as their source. Reflex movement and the accompanying sensation are given as the typical example of such a concomitance. (This seems to be directed against James.) Some psychologists think that the simple sensations suffice, others call in the concomitant excitations. But all materialistic psychologists agree in the tendency to exchange the psychical process for some tangible, but usually hypothetical, physical process.[2]

The third period ends, in the second edition of the *Logik*, by the first explicit discussion of the method of feeling-analysis. As we saw in the previous paper, the *Logik* sets up two criteria for the element, besides the general condition of analysis: that of non-decomposability, and that of possible isolation as an object of attention. This second criterion cannot be met by feelings, for they vanish when the sensation is 'thought away.' They cannot, therefore, be called *independent* elements in the same sense as the sensations. There have been attempts to make them so, either by making them a specific class of sensations, or else by holding that pleasantness and unpleasantness are individual unchanging feeling qualities, instead of mere class-notions. Such attempts simply contradict the plain facts, and the men who assert that these positions are borne out by their introspections do not deserve to be argued with. It is a mere dogmatic prejudice that all subjectively unanalyzable constituents of consciousness must be possible isolated objects of attention. There are simple unanalyzable feelings, but they cannot be isolated in the same way as sensations, because they have no objective reference. The methods of feeling-analysis differ, therefore, from those of sensation-analysis, and are more difficult to apply.[3]

Because of this difficulty, psychologists too often have recourse to unaided introspection in this field, which usually means that they accept such dogmatic prejudices as those of the sensationalistic and dualistic theories, against which Wundt does not deign to argue, at least not here. Such unaided in-

[1] *Studien*, X, 46.
[2] *O. c.* 57-58, 84.
[3] *Logik*, II, 2 (*der Geisteswissenschaften*), 198-199.

trospection has the further difficulty that it cannot, with certainty, separate all ideational contents from the affective. The only certain method is, therefore, the experimental variation of the conditions, the method of *impression*, the essential feature of it being that it allows the change of only one of the elements in a complex phenomenon at a time. Since the results of the method of *expression* are physiological, it must be classed among the auxiliary physiological methods. However, it has an indirect psychological value, since it aids analysis.

Three special difficulties of feeling-analysis are indicated. Its most important forms can be genetically investigated only in folk-psychology. Its conditions are immensely complicated, and include indirectly, through association, the whole past history of consciousness. Finally, there is an extreme paucity in feeling-nomenclature; the names we have are merely generic, such as pleasantness and unpleasantness.[1]

The third period has, then, thrown some light upon Wundt's theory of feeling-analysis. We cannot, it is true, isolate feelings in the same way as we do sensations; but we can indirectly isolate them *from each other* by the isolation of their perceptual substrate,—given, of course, invariable subjective attitude. This method of indirect isolation, which is pointed out in the *System der Philosophie*, would seem to be the necessary preparation for the feeling-analysis proper described in the *Logik*. The feeling and the perceptual content which arouses it being thus isolated, we discover whether the feeling is simple by varying, one at a time, the elements in that content. If the components in the feeling-reaction vary as a result, or some of them drop out or are added, the feeling is of course not simple. If, however, the feeling is found to disappear or change in its entirety by the alteration of a single element in the perceptual stimulus (once that stimulus has been precisely defined by elimination), then it is simple. This seems to be what Wundt means, and it implies that when the perceptual substrate of a feeling is itself an elementary sensation, then the feeling attached to it is (psychologically) unanalyzable and simple. This question will come up for further discussion later on.

Nothing explicit, however, has been done in the way of giving some psychological meaning to 'subjective.' Wundt has established simple feelings as elements because, like sensations, they can be independently experienced in varying relations, while themselves unanalyzable. What justifies him in making them a *different* class of elements is still their 'subjectivity' as contrasted to sensational 'objectivity.' As we have pointed out, there seems to be some ground to hold that one

[1] *O. c.* 215-223.

connotation of the term is lack of correlation with definite physical stimulus. Very analogous to this is the reference, which has been implicit from the first, to total disposition of consciousness as against particular perceptual experience. But as yet we have no clear connection of the term either with these or with any other introspective description.

This description is supplied in the first edition of the *Grundriss der Psychologie*. The book is important both for this reason and because it gives the first full statement of the final development of Wundt's theory of feeling. It is necessary, therefore, to examine its treatment carefully.

The two classes of elements, sensations and simple feelings, correspond "to the two factors present in immediate experience, the objective contents and the experiencing subject." Both sensations and feelings possess the attributes of quality and intensity.[1] They differ as to certain attributes connected with the immediate relations of sensations to objects, and of feelings to the subject. (1) The qualities of sensation move between maximal differences; those of feeling, between maximal opposites. (2) Simple feelings are much more numerous and various than simple sensations, because (a) "every sensation of the many-dimensional systems belongs at once to several series of feelings," and more especially because (b) simple feelings appear as the subjective complements not only of simple sensations, but also of ideas and of ideational complexes. (3) Sensations fall into separated disparate systems, feelings form a single connected manifold, for every feeling has some qualitative relation to every other feeling. This third difference shows that the origin of feeling is more unitary than that of the sensations. It is the same distinction as that between the unitary subject and the plurality of objects.[2]

This seems explicit. If this third difference is the same distinction as that between subject and objects, then what Wundt means by 'subjective' is, psychologically, the unitariness, the connectedness, of the affective side of experience. That this is the case is, we think, made clear by a passage which immediately follows.

Since, says Wundt, we can isolate sensations from feelings, but never feelings from sensations, we cannot speak of *pure* feelings as we can of pure sensations, and the false view may arise that sensations are the cause of feelings, or that feelings are a particular class of sensations. The first view cannot be held, because feelings always derive from the attitude of the subject, so that the same sensation may be accompanied, under different subjective conditions, by different feelings. The

[1] *Outlines* (1st English ed.), 28-30. [2] *O. c.* 33-35, 81-82.

second view is also untenable, because "the two classes of elements are distinguished, on the one hand by the immediate relation of sensations to objects and of feelings to the subject, and on the other by the fact that the former range between maximal differences, the latter between maximal opposites." [1]

Now in the passage quoted Wundt obviously uses the subjective-objective criterion as entirely equivalent to the third difference in his list. He is quoting the two differences of feeling as such from sensation as such, and they are given in the first and third of his list of distinctions; the second in the list is merely an external mark derived from the peculiar nature of feeling-conditions, not a specific difference. The first difference in the list he quotes precisely; the other formula may therefore be regarded as equivalent in meaning to the third, and our previous conclusion is made certain.

The 'subjective' nature of feelings, therefore, means their connectedness, their tendency to fuse together; the fact, as Wundt puts it, that they form a *single* system, and that an interconnected manifold, in which every feeling is in some way related to every other, while sensations fall into a number of disparate systems. This agrees perfectly with the hints of Wundt's meaning which we have come upon already. The syncretistic tendencies of feelings, the impossibility of grouping them in definite systems, has as its psychophysical parallel the lack of correlation with definite physical stimulus, and as its psychological the reference to total conscious disposition instead of to particular perceptual experience. It also explains why he has repeatedly said that attention cannot isolate a feeling as its object because feeling 'has no objective reference.' What he meant was, that a feeling is not definitely marked off by its dependence on a particular kind of physiological stimulus, or by its place in a particular modality of experience.

This being granted, then, let us proceed with our review. Wundt has shown that it cannot be maintained, either that sensations are the causes of feelings, or that feelings are themselves sensations. "Because of the objective and subjective factors belonging to all psychical experience, sensations and feelings are to be looked upon as real and equally essential, though everywhere interrelated, elements of psychical phenomena." [2] The other possibility, that feeling might be a third attribute of sensation, is disproved by the fact that the affective tone of a sensation changes in *both* quality and intensity for every change in either quality or intensity of sensation. [3]

Simple feelings attached to simple sensations are easily iso-

[1] *O. c.* 37. [2] *L. c.* [3] *O. c.* 78.

lated from their connection by the same method which isolates the sensations; but those belonging to complexes "can never be separated from the feelings which enter into the compound as subjective complements of the sensation." For example, the feeling of harmony connected with a chord can never be dissociated from the feelings attached to the single notes of the chord.[1]

Sense-feeling cannot exist without the sensation, nor has each given sensation a given feeling. Feeling depends on sensation *and* disposition. There is, therefore, a double abstraction involved in getting at the sense-feeling. The feeling must be distinguished from the concomitant sensation, and also, as unvarying, from all the other feelings connected with that sensation under varying conditions. This second abstraction is very difficult, because the associative factors are always present. Because of this difficulty some psychologists have disbelieved in the existence of any pure affective tone of sensation, and hold that the affection is always due to the associated ideas. But experiments in color sensation show the contrary, for the affective tone of color is greatest when its saturation is strongest, and it is most unlike the colors of familiar natural objects. The uniform choice of particular musical tones to express particular feelings is another disproof of this theory.[2]

Every sensation in a multidimensional system has an associated feeling which is "a resultant of the affective elements due to its position in various dimensions." The discrimination between simple and composite feelings, therefore, cannot be carried out. Both are alike irreducible. The union of some feelings "gives rise to feelings which are not only unitary, but even simple in character."[3]

There are three *chief directions* of feeling in the feeling-manifold: pleasantness-unpleasantness, excitement-depression, strain-relaxation. Any concrete feeling may belong to all three, to two, or to only one of these. Organic sensations, smell, and taste, arouse especially feelings of the first direction; color and clang sensations, those of the second; those of the third are connected with the temporal course of processes, as for example the feelings of expectation and of satisfaction. We may assume that these three directions "depend on the relations in which each single feeling stands to the *whole succession of psychical processes.*" A feeling has a place in the first in so far as it represents the state of the present moment; in the second, in so far as it exerts a definite influence on the succeeding state; in the third, in so far as it is determined by the preceding state. Such a connection makes it improbable that

[1] *O. c.* 74-75. [2] *O. c.* 29, 75-77. [3] *O. c.* 79-82.

other such chief directions exist. These directions also enable us to find in the affective elements the antecedents of the fundamental forms of the emotions. Finally, Wundt concludes his discussion by the remark that the sensationalistic and dualistic theories are beneath criticism.[1]

This first edition of the *Grundriss* adds much to our knowledge of Wundt's doctrine of feeling. Here for the first time we find the three directions of feeling, and their connection with the temporal course of consciousness. Here, too, is added an important distinguishing character of feeling not noticed before, that of movement between maximal qualitative opposites. Most important of all, what has hitherto been referred to as the *subjective* character of feelings is given a psychological meaning. This is, that feelings form a single interconnected manifold, all feelings are qualitatively related, while sensations fall into disparate systems. Nothing new is said concerning feeling-analysis, but the statement that simple and composite feelings are alike irreducible when they attach to a simple sensation shows that Wundt recognizes the implication in his theory of analysis which we pointed out a few pages back.

The only new thing in the second edition of the *System der Philosophie* is that it relates the three feeling-directions to the temporal course of consciousness in terms of *will*. In the pleasantness-unpleasantness components, a given direction of will is qualitatively specified; in the excitement-inhibition, the degree of energy of will is indicated; in the strain-relaxation, the particular stage of the volitional process is defined.[2]

Such changes as appear in the fourth and fifth editions of the *Grundriss* are all in the direction of increased caution. The statement that "the union of certain feelings gives rise to feelings which are not only unitary, but simple in character," is omitted in the fourth edition.[3] The connection of the three directions of feeling with the three aspects of consciousness has disappeared. This is probably the most important change. The reference to dualistic and sensationalistic theories of feeling as beneath criticism has gone, and in its place appears a brief statement of reasons for rejecting them. They are either entirely inadequate to deal with the problems of complex emotions, or else meet them by substituting reflections for feelings, as in the intellectualistic explanations of æsthetic pleasure. The supposition that the six classes of feeling-qualities, which appear as the poles of the feeling-directions, "are themselves simple, concrete qualities," while it seems to be supported by the introspection of hypnotized subjects (*cf.* Vogt), is contra-

[1] *O. c.* 82-85.
[2] *Syst. d. Phil.*, 373.
[3] *Cf. Grundr.*, 4th ed., 91 with *Outl.*, 1st ed., 82.

dicted by the feeling-phenomena attached to colors and tones. These differ not only in quantity but also in quality. The quieting effect of sky-blue is not quite that of indigo-blue, the pleasure aroused by the interval of the third is not the same as that aroused by that of the fifth. Nor does it seem possible to account for such differences by assuming the admixture of another feeling. The lack of terms for such finer shades of feeling is no argument against their existence, for such a lack exists also in the case of sensations, though to a much less degree.[1]

In the fifth edition, the phrase "objective contents of experience" is substituted for "objects" in the clause "the immediate relation of sensations to objects and of feelings to the subject."[2] This connection is in line with the psychological definition of this contrast which Wundt has now given. The feelings arising from the fusion of sense-feelings, as the sensations to which they attach are united in ideational complexes, are not called "simple" in character, but "subjectively unanalyzable," "unanalyzable in themselves." The test of invariability under varying conditions, as marking the feeling-tone of simple sensations, is not mentioned. As originally stated, it was plainly at variance with Wundt's whole doctrine of feeling. The statement is also expunged that the feeling attached to a sensation of a multidimensional system, though composite because of its place in the several dimensions, is "as irreducible as a feeling of originally simple nature."[3] One's general impression from these changes is that Wundt is now inclined to believe that the feeling-tone attached to some simple sensations may be analyzable because of the possible independent variation in the components of the sensation. For example, we may vary independently brightness, saturation, and color-tone of a color, and thus perhaps establish a division between constituents of its feeling-tone, if it happens to be really not a unitary fusion.

Full as the treatment of feeling is in the fifth edition of the *Physiologische Psychologie*, it adds little but development and confirmation to what has already been outlined as Wundt's general theory of the feeling-elements. Still, it is necessary to examine it with some care, since it is in all probability his final pronouncement on the subject.

---

[1] *Grundr.*, 4th ed., 94-95.

[2] *Cf. Grundr.*, 5th ed., 45, with *Outl.*, 1st ed., 37 and *Grundr.*, 4th ed., 40.

[3] *Cf. Grundr.*, 5th ed., 92, 99 with *Outl.*, 1st ed., 74, 82; 76; 79; and *Grundr.*, 4th ed., 86, 88 (and 91, which prepares the change at 99 of the 5th ed.).

The composite psychical processes fall into objective and subjective classes, Ideas and Emotions.[1] Accordingly, psychological analysis points out two classes of elements: "sensations, the ultimate unanalyzable elements of ideas, which we accordingly may call the *objective* elements of psychic life, and *feelings*, which accompany these objective elements as their subjective complements, not referred to external things, but to the conditions of consciouness itself."[2] That is, "in the inseparable whole which we call a sensation of fixed quality, intensity, and feeling-tone, the latter represents the constituent which we conceive as the *subjective* reaction of consciousness upon our impressions, while we assign to (the impression) the intensity and quality of the sensation as its objective attributes."[3] Simple sensations and feelings are then the *irreducible* elements of experience. The task of psychology is not to attempt to derive them from some common middle thing which we never experience, but to show their general relations. They appear as the complementary elements of psychic life, representing its objective and subjective sides, since it is made up of the "experiences of experiencing subjects." "Feeling-tone is accordingly in so far a necessary complement of sensation, as each sensation belongs to a sensing (*empfindend*) subject." It stands as a subjective factor beside the objective, to express the relation of the subject to the impression. This difference shows itself immediately in the fact that we objectify our sensations but not our feelings, which we conceive rather as our own subjective experiences, the reactions of our consciousness upon the objective impressions given in sensations.[4]

These passages have been purposely given *in extenso*. They certainly, at first glance, seem very epistemological in character, but we must remember that if our previous understanding of him was justified, all Wundt can mean by this distinction of objective and subjective is just the difference between those parts of experience which we can definitely particularize in attention, and those which, whether because of their functional interdependence with the attentional process or for some other reason, we cannot so separate. If we look at the actual differences between sensation and feeling, which the *Psychologie* in various passages indicates, this is, it seems, what they all centre in, here as elsewhere.

In the first place, then, the physical conditions of sensation are for the most part external and obvious in the organism, while those of feeling are hidden and complicated.[5] But more especially, the psychical attributes of sensation are much sim-

[1] *Phys. Psych.*, (5) I, 344.
[2] *O. c.* I, 14, 350.
[3] *O. c.* I, 354.
[4] *O. c.* II, 356.
[5] *O. c.* I, 353.

pler, being only, in general, intensity and quality, while feeling has various additional characteristics. (1) *Feelings move in contrasts* (*i. e.*, between opposites).[1] (2) They form a single interconnected manifold. There is a *general relationship* of feelings which are referable to wholly heterogeneous objective sensations. *All* sensations may arouse pleasantness or unpleasantness, may excite or depress us. Hence the feelings are the chief source of the connections and relations in our mental experience.[2] (3) The feelings present at any moment always tend to fuse into a *total* feeling expressing the collective feeling-content of consciousness at that moment. For this reason the simple feelings are difficult to fix upon, for they fuse into partial feelings, and partial feelings fuse into total.[3] This tendency of feelings to fuse, and the connectedness of the feeling-continuum in general, is to be explained by the fact that every feeling is "a reaction of apperception upon the single conscious experience;" for the unity of consciousness is due to apperception.[4] (4) Finally, and as a result of all these characteristics, feelings cannot be attended to for themselves as sensations can.[5]

Now these characteristics of feeling, taken together, only recapitulate those marks of its subjective character which we have found indicated elsewhere. That is to say, feeling is not correlated with definite physical stimulus, it is to be referred to the totality of consciousness, it refuses to be grouped into definitely separate forms, and, finally, as the result and summing-up of all these qualities, it is always falling into unitary masses, it forms a single continuum. This, then, we may take as Wundt's final meaning in psychology for *subjective*.

The refusal of the sensationalists to accept this separation between feelings and sensations Wundt meets by the assertion that their doctrine is not really psychological, but due on the one hand to the influence of Herbartian intellectualism, and on the other to that of the physiology of sense-perception. The psychologists who hold it demand that there shall be only *one* kind of element, that produced by the stimulation of definite sensory nerves or of their end-organs. This demand is stated as a necessary dogmatic presupposition; it is also stated as a result of immediate introspection (Ziehen, Münsterberg). But

[1] *L. c.* [2] *O. c.* I, 353; II, 308. [3] *O. c.* II, 308, 341.

[4] *O. c.* II, 341, 357. We may add in passing that we are unable to find in these passages, which are those cited by Dr. Washburn, *Phil. Rev.*, Jan., 1905, p. 21, any justification for her statement there that Wundt refers the unity of feeling to the *physiological* unity of the apperception-centre. At II, 360-362, he hazards the surmise that the connectedness of the expressive movements of affection, vascular and otherwise, may be due to such a centre.

[5] *O. c.* I, 352; II, 305, 308.

the dogma is not self-evident. If anything, the position is *à priori* improbable, for it is natural to look for different elements on which the distinction of subject-object which runs all through our mental life may be founded. The real source of the dogma is not, then, *à priori* probability, but the long-rejected sensualistic theory of knowledge. As for the asserted introspective evidence, it is not found by the unbiassed observer. Empirically, such an hypothesis can account neither for the connection of like feelings with entirely disparate classes of sensations, nor for the connection with complex processes of feelings which are the same in type as those accompanying simple sensations. To explain the unity of feeling, it has recourse to a hypothetical 'common-sense.'[1]

The *Psychologie* adds nothing to the theory of feeling-qualities beyond a more explicit statement of the general position. Feelings have quality and intensity, and, besides these, other attributes due to their position in the unitary feeling-continuum, which is, as before, tri-dimensional. That is, their quality is a function of their place in these three dimensions, which we may accordingly call the *components* of feeling-quality. These components are not real feelings any more than the components of a motion are real motions, or than color-tone, brightness and saturation of a color-sensation are real sensations. Immediate introspection shows that they are "basal forms, each one of which includes a number of feeling-elements, but not concrete particular feelings, which reappear in unchanged quality in each single case to which we apply the names given to them." Thus, for example, the pleasure of the taste of sugar and that of the smell of menthol are alike in *direction*, but they are not at all *similar*.[2] The feeling-tone of a sensation depends for "its peculiar quality, specific for each sensation," upon the quality of that sensation.[3]

Nothing new is said concerning the criteria of feeling analysis, but it is important to note carefully what little is mentioned. Its methods are those of impression and expression, and in the former the sensation which is the *direct* result of the stimulus is used only as a means to arouse the feeling.[4] Simple feelings are like simple sensations in the possibility of separating them from their connection by analysis, and in the fact that in this process they become in a sense abstractions.[5] But while sensations can be abstracted from feelings, feelings cannot be abstracted from sensations.[6] Of the two conditions for analysis which are mentioned in this work, therefore, 'independent variability' and the isolating effect of attention, the latter is not

[1] *O. c.* I, 352, 359-360.
[2] *O. c.* II, 305-308.
[3] *O. c.* II, 318.
[4] *O. c.* II, 263.
[5] *O. c.* I, 308.
[6] *O. c.* I, 352.

mentioned in connection with feeling analysis. This has already been emphasized in a different connection in the preceding paper. Simple feelings Wundt defines as those which cannot be separated into simple feelings appearing independently for themselves.[1] This definition connects itself quite clearly both with the general method of analysis and with the method of feeling-analysis, as it has been already described. The simple feeling is one which can appear for itself in changing relations to other mental content, but which cannot itself be divided by division of its sensational substrate, or, under the further refinement introduced in the *Grundriss*, by variation of the components of that substrate, if it happens to be a sensation belonging to one of the multidimensional systems. Finally, it is essential to remember that Wundt has already stated that feeling-tone is "specific for each sensation."[2]

To sum up, then, we find that in this last work the objective-subjective distinction between sensation and feeling is strongly emphasized. But it is given introspective content. The unitariness of the feeling-continuum is dwelt upon, as it was in the *Grundriss;* and to the first and third of the special characteristics of feeling there pointed out, there is added a further result of this unitariness, the tendency of feelings to fuse into a mass or total-feeling. This unity of feeling is referred to the unity of apperception; that is, to the unity of mental processes as a whole at any given moment.

The quality of a feeling is made a function of the three 'dimensions' of the feeling-manifold as components. Wundt's statement of pluralism remains as dogmatic as before. He has no hesitation in appealing in justification of his own position to that 'immediate self-observation' which he justly censures when employed by his opponents. But his explanation of the three 'directions' by connecting them with the three temporal aspects of mental process has disappeared, and in its stead he seems inclined to find an analogy in the three dimensions of the color-system.

In concluding, it does not seem necessary to restate what, as it seems to us, we must hold that Wundt means by the terms subjective and objective as applied to feelings and sensations respectively. His meaning is psychological, and he is not using an epistemological distinction, as Dr. Washburn supposes. Indeed, his meaning for 'subjective' includes as one of its elements just that lack of localization which the critic herself admits as part of its psychological meaning.[3] With her conclusion that only the pleasantness-unpleasantness feelings fully satisfy the

[1] *O. c.* II, 305. [2] *Cf. ante.* [3] *Cf. Phil. Rev.*, Jan., 1905, pp. 26 ff.

psychological definition of subjective, either in her own sense or in that broader one which we have outlined, we are inclined to agree; but that is a matter which does not concern us here.

Nor does it come within the province of this paper to discuss the validity of Wundt's grounds for separating feelings from sensations. But it is not, perhaps, over-captious to ask why the critic seems to slight the first of the three distinctions given in the *Grundriss*, that of movement between qualitative opposites, when pointing out the insufficiency of the second, upon which Wundt seems to lay no special stress, and which does not appear in the *Physiologische Psychologie*. Given Wundt's general position, the fact that he finds a certain class of conscious phenomena ranging in quality between conscious opposites, and falling into a unitary interconnectedness which can, as it were, indifferently include all the disparate systems of other elemental conscious phenomena, seems no insufficient reason for regarding that class as different in kind from these other phenomena. It must also be remembered that we have found his actual reasons for the distinction to be more inclusive than his explicit statement of them.

As to Wundt's theory of feeling-analysis, it seems to us that such a review as that just completed is almost indispensable to make one's view of it clear. As we have found, it depends on the method of impression and on that of expression. The latter method is, however, merely an auxiliary guide in the actual task of analysis. While we cannot isolate a feeling as an object of attention, yet we can isolate it mediately by the isolation of its perceptual substrate. Once isolated in this way, we attack it in the method of impression by varying, one at a time, the elements in that substrate. If in this way we can eliminate some of the aspects or constituents of the feeling, while retaining others, it is complex; but if we can make no such breach in it, it is—subjectively at least—unanalyzable. If, finally, we have come upon a feeling which has an elementary sensation as its basis, that feeling is, *ipso facto* and by the terms of our analysis, psychologically unanalyzable; for we can introduce no variation within its sensational stimulus. The only exception to this rule is in the case of the sensations belonging to multidimensional systems, such as light, where the possible variation of the components of the given sensation may establish a division in the feeling-tone.

Looking at the criticisms of Dr. Washburn's second article with these facts in mind, we see that Wundt would accept none of the three methods for establishing the simplicity of a feeling which she suggests as the only ones possible on his definition. The first two, that of appeal to introspection and that of appeal to the uniqueness of the sensational substrate, are incompatible

with his whole line of argument, as she herself points out. The third suggestion is, that we ground our distinction of the simple feelings from the complex "on our knowledge that the sensational source of the so-called simple feelings is simple, while the so-called complex feeling is derived from a complex sensational source."[1] This contains an element of Wundt's method, but a very partial element. Complexity of sensational source would not determine complexity of feeling for him. That would be a point to be settled by experimental variation in the elements of the complex sensational stimulus. On the other hand, when we have a sensational substrate not only simple, but also such that we cannot even vary its components —a sensation belonging to a one-dimensional system, for example—then we may be sure that the feeling attached to it is psychologically simple. For, as we have seen, the feeling of each sensation is specific for that sensation, and the invariable stimulus must produce invariable feeling-reaction. The feeling cannot, therefore, be duplicated elsewhere in experience, and no division can be introduced into it; and such a feeling is, for Wundt, simple.

It may be well, in closing, to sum up categorically the points on which we have found it necessary to take issue with the critic both here and in the preceding paper. Dr. Washburn's criticisms were: (1) It is not clear whether Wundt's criterion of analysis, independent *variability*, includes independent *existence*. (2) His criterion for the attributes, independence of the mental context, is insufficient to rule out clearness as an attribute. (3) His distinction between feelings as subjective and sensations as objective is epistemological and extra-psychological. (4) His reference of the unity of feeling to that of apperception, and his consequent definition of the simple feeling, make it impossible to distinguish between simple and complex feelings, save by reference to their sensational substrate.

But we have found that, when the whole development of Wundt's doctrine is examined, and the actual way in which he goes to work at his problem, none of these criticisms is valid. More specifically we find that (1) what marks off the element in Wundt's eyes *is* its separability, the fact, that is, that while no breach can be made in it, yet it can be experienced in different mental contexts. (2) Wundt has *four* criteria for the attributes, instead of merely one. These are structural necessity, independent variability, inseparable connection, and independence of the complex. He regards clearness as excluded

[1] *Phil. Rev., ut ante*, p. 26.

by the last two of these. (3) The difference between feelings and sensations, as subjective and objective, is not for Wundt epistemological, as he has explicitly disclaimed his own earlier theory of that nature, but psychological; and he has given it introspective definition as a contrast between tendency to fusion and persistent discreteness. (4) Wundt's canon of analysis is the same for feelings as for sensations, though his method is necessarily different; and the reference to sensational substrate involved is never regarded as directly settling the question of the simplicity or compositeness of the feeling, which is on the contrary determined by experimental variation of that substrate considered as the feeling-stimulus.

Finally, it must be admitted that these criticisms are of real service in pointing out inadequacies in the immediate statements of Wundt on these matters. We have been able to find no single discussion of them in his works which was entirely clear and sufficient by itself. Such criticisms of method and definition are always useful in the case of authors who, like Wundt, have been constantly busied in a varied literary activity, and that in a science which has been too much occupied with growth to examine its presuppositions. They force his students at least to attempt to get a more precise idea of his meaning; and sometimes they elicit a final attempt at definition from the master himself. Such a result in this case would be most desirable.

PERIPHERAL AND CENTRAL FACTORS IN MEMORY IMAGES OF VISUAL FORM AND COLOR.

By ELSIE MURRAY, A. B.

(From the Psychological Laboratory of Cornell University.)

The observations recorded below were made in the Cornell laboratory in 1904-5. The general object of investigation was the appearance, recurrence, and duration, in immediate memory, of visual images of simple figures. The purpose of the study was to ascertain whether figures viewed under uniform conditions of attention differ in reproductivity; and, if so, whether or not these differences can be correlated with certain intrinsic characteristics of the figures, such as size, brightness, color, outline, complexity of contour.[1]

It is a familiar fact in every day experience that, under favorable conditions, memorial images of objects recently experienced tend to recur spontaneously. This fact the experiment sought to turn to account in attacking the problem of the intrinsic liability to recurrence and persistence of images of different figures. The study of the spontaneous recurrence of images was chosen, and voluntary retention expressly forbidden. This procedure, it was believed, promised most toward the elimination of chance reinforcements through associations and purely subjective factors, and was hence more likely to lay bare any relation subsisting between the reproductivity of the figure and size, brightness, etc.

In the first group of observations, the individual durations and the number of appearances of memory images of different figures were recorded. It soon became evident, however, that

[1] This problem, along with the involuntary procedure in the study of images, was suggested by an article by F. Meakin: Mutual Inhibition of Memory Images, *Harvard Psych. Studies*, Vol. I, 1903, 235. In this article, which deals with data relating only to simultaneous observations on a double set of images, the author generalizes with regard to the conditions of reproduction of a *single* image, and concludes that the persistence of an image depends on the activity of its motor accompaniments, and that these motor accompaniments are conditioned by the size, brightness, etc., of the figure. (See I. M. Bentley's critique, *Phil. Rev.*, Vol. XIV, 1905, 253). The method here followed differs from that of Meakin in utilizing one, instead of two figures at a time, thus securing uniform and undivided attention for each; and in recording the duration of each image with greater accuracy.

in the procedure followed the conditions of reproduction were complicated by such factors as affective tone, contrast, familiarity, and associations; and that distinctness and vividness were more constant and more significant factors than mere duration or recurrence. In later groups, accordingly, precautions were taken, especially in the ordering of the series, with a view to further elimination of these disturbances; and a record also of the distinctness and completeness of images was kept.

The second group of experiments was arranged to investigate the relation obtaining between the motor conditions excited by a figure, and the distinctness and duration of the corresponding visual image. The special object here was to verify the conclusions of Meakin[1] and Slaughter[2] as to the dependence of the stability and clearness of the image upon ideated or realized eye-movements. In the third group both voluntary and involuntary recall were studied with a view to discovering whether constant differences in distinctness, completeness and duration hold only for passive attention or run parallel in voluntary and in involuntary recall; and, secondly, whether these differences are correlated with the incentives to sensory attention afforded by the figure.

Group I. Involuntary Method with Fixation.

MATERIALS.

Geometric figures cut from colored or neutral-tinted papers were used. These were arranged in five series of four members each, each series being designed to test the dependence of the memory image on a certain factor. The varying factors were outline, complexity of contour, size, color and brightness. The series were made up as as follows:

Ser. I. 1) ellipse, 2) triangle, 3) disc, 4) square—each of medium gray, with a surface of about 12 sq. cm.

Ser. II. A duplication of Ser. I with notched instead of plain line margins.

Ser. III. Discs of the standard gray, of graded sizes, in the ratios 1 : 2 : 4 : 8 and 3-7 cm. in diameter, the next to the smallest identical with the disc of Ser. I.

Ser. IV. Discs of the standard size of Ser. I, of white, light gray, medium gray (the standard gray of Ser. I-III), and black.

Ser. V. Discs of the standard size of Ser. I in saturated red, green, blue, and yellow.

These series were given in the order IV, II, V, I, III. The sequence within the series was haphazard, but constant throughout the whole experiment, being merely reversed every other observation period.

---

[1] *Op. cit.*

[2] A Preliminary Study of the Behavior of Mental Images. *Am. J. Psych.*, XIII, 1902, 526.

METHOD.

The recurrence and duration of the memory images were recorded on a revolving drum by means of a key operated by the observer. The observer sat before a table on which, at a constant distance of 65 cm., stood a large black felt screen. Each figure was exposed in turn at the centre of this screen for 4 sec., during which period the observer steadily fixated a point at the centre of the figure. At the end of the fixation period he received a signal to close his eyes. After a pause of 15 to 20 sec., to permit the fading out of after images, he was given a ready signal, and immediately placed his finger on the key preparatory to recording the course of the memory image. The instructions to the observer were to await as passively as possible the entrance to consciousness of the visual image of the figures, indicating its appearance by a light pressure, its disappearance by release of the key. At the end of the record minute, the observer reported briefly on the completeness and distinctness of the image. On the completion of the series, a general introspective account of the course of the image, associations, direction of the attention, variations in the disposition of the observer, was given. The observations were repeated at intervals of one week, in reverse order. The practice observations are excluded from the averages (Table I), which represent five observations for each figure. A special set was also given in which a full introspective report was taken immediately after each record minute.

The observers [1] represent two rather different types, P. being a good visualizer, while C. was predisposed to motor imagery. At the start, both encountered some difficulty in assuming the semi-passive attitude demanded by the experiment, and in attending simultaneously to the elusive flittings of the memory image and to the manipulation of the key. After a moderate amount of practice, however, the temptation, to voluntary recall or filling out of the image was less insistent and the observer's response to the appearance and disappearance of the image through the pressure and release of the key became fairly automatic. A tendency to the formation of an artificial rhythm was anticipated, but seems to have played a very inconsiderable part.

I. *Introspections.* 1. Manner of appearance of image. As a rule, the memory image appears spontaneously at the beginning of the recording period, or in the preceding after

[1] The writer wishes to acknowledge her indebtedness to the two observers, Miss Peirson and Mr. Coffin; and to Professor I. M. Bentley, under whose direction the investigation was undertaken and completed.

TABLE I.

	Obs. C.							Obs. P.						
	(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) M. V.	(6) Tot. dur. for series.	(7) Av. dur. for series.	(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) M. V.	(6) Tot. dur. for series.	(7) Av. dur. for series.
Ser. I, Disc	65.7	2.2	.4	6	.8	257.5	2.2	38.6	1.1	.5	6.8	2.5	219.2	1.4
Ellipse	61.5	2.2	.3	5.4	.8			50.1	1.3	.5	7.2	3.4		
Square	61.4	2.2	.3	5.4	.4			76.1	1.8	.7	8.2	1.1		
Triangle	68.9	2.3	.4	5.8	.3			54.4	1.4	.8	7.6	1.7		
Ser. II. Disc	55.7	2.1	.4	5.2	.6	265	2.3	35	1.6	.3	4.2	3.8	236.9	1.6
Ellipse	66.9	2.5	.7	5.2	.9			75.6	1.8	.8	8.2	1.9		
Square	75.4	2.7	.6	5.6	.9			74.1	1.9	.9	7.6	3.6		
Triangle	67	2.2	.4	6	.4			57.2	1.3	.6	8.2	1.8		
Ser. III. Size 1	56.6	2.4	.5	4.6	.7	249	2.4	62.2	1.6	.8	7.6	1.6	228.7	1.8
" 2	66	2.3	.5	5.6	1.2			37	1.1	.6	6.6	.8		
" 3	56.8	2.4	.6	4.6	1.1			37.1	1.2	.7	5.8	1.8		
" 4	69.6	2.4	.5	5.8	1			92.4	3.5	2.5	5.2	1		
Ser. IV. Red	63.3	2.1	.4	5.8	.9	296.7	2.3	64.1	1.7	.9	7.2	1.5	271.3	1.8
Blue	81.7	2.5	.7	6.4	.8			58.6	1.3	.5	8.4	2		
Green	90.9	2.6	.5	6.8	.6			70.3	2.1	1.3	6.6	1.5		
Yellow	60.8	2.1	.6	5.6	1.1			78.3	2.2	1.1	7	1.2		
Ser. V. White	80	2.4	.5	6.6	1.4	296.7	2.3	126.4	3.5	1.9	7.2	2.6	344	2.2
Lt. gray	82	2.4	.5	6.8	1.3			67.3	1.9	.9	7	1.2		
Med. gray	68.9	2.3	.5	5.8	1.2			47.3	1.6	.5	5.8	2.9		
Black	65.8	2.2	.4	5.8	.7			103	2	1.7	6.8	2.9		
						Gen. av. 2.3							Gen. av. 1.7	

In the above Table, column 1 gives the total duration of memory images in five observations.

2 and 3, the average duration of single image, and mean variation.

4 and 5, average number of images per minute and m. v.

6, total duration of image for series (five observations).

7, average duration of single image for series.

image period. Thereafter it returns at irregular intervals, which usually grow longer toward the end of the minute. On a few occasions, C. reports, the image was apparently evoked by chance twitches of the eyeball or eyelid, by inspiration, or, automatically, by rhythmic pressure of the key. Occasionally, also, the observer reports a faint anxiety at the momentary failure of the image, and a temptation to summon it by movement of the eyes (*O.* C.), by steady fixation, or by recall of detail after detail (*O.* P.).

2. Localization of image. The memory image usually appears in the same direction and at the same distance as did the original. P. distinguishes it from the sensory after image by its position outwards on the screen (the after image appearing

"on the eyelids"), and remarks that "its appearance is often accompanied by the feeling of turning toward it." Occasionally it seems to be situated "in the head," but in this case its distinctness is materially lessened.

That this localization is correlated with the presence of motor elements, actual or ideated, has abundant evidence. Thus C., noting that the memory image usually appears as an object with spatial relations, states that in this case "the feeling of accommodation" is present, with the "tendency to move the eyes and locate the image directly in space." The less real this feeling (of accommodation and convergence?), the less distinct the image. Thus, toward the end of the recording period (C. sometimes reports), the images become less vividly 'visual,' are accompanied by almost no tendency to fixation, and are localized, not in any definite portion of the visual field, but vaguely, 'in the head,'—a type of image described by C. as 'more subjective,' or 'more purely memorial.'[1]

It seems probable that P. also refers to the muscular sensations attending fixation in her less concretely phrased account of the semi-spontaneous recall of images. "I seem to turn my attention toward the place where I expect the image to appear. If I hold my attention on this place, several more images are likely to follow." And again, "my attention vacillates about the place on the board where the image is expected, then settles down, and below unfolds the image, sometimes indistinctly, but as the attention turns more decidedly toward it growing in vividness."

3. Incompleteness of image. Images are rarely complete. The lower right hand portion is most often missing, and the upper left hand portion the most distinct,—a condition possibly correlated with the characteristic grouping of matter on the printed or written page, and the acquired habit of attending primarily to the upper left hand word. In cases where the outline is complete, it is often doubtful whether there are not gaps in the main body of the figure. Whether complete or incomplete in relation to the original, the image is usually reported as flashing in and out as a whole, without growth or alteration.

II. *Duration and Frequency.* 1. General uniformities and variations. Two points are first to be noted, the wide fluctuation in individual values for the same figure, and the smallness of the differences between the averages for different figures. The durations for the figures showing the greatest variation

[1] C.'s feeling of unreality with regard to reproductions of purely retinal elements is interesting in view of his already mentioned 'motor-mindedness.'

swing between the limits 16.8 sec. and 0.4 sec.; and, in a typical case, a mean variation of 0.6 sec. stands with an average of 2.7 sec. (*O.* C.), and a m. v. of 0.9 with an average of 1.9 (see Table I, columns 2 and 3). A glance at the Table will show that, in comparison with these mean variations, the differences between averages for the single figure (column 2), or between averages for the series (column 7), are too slight to be used incautiously as the basis of generalization. It may here be noted that the magnitude of the mean variation is due in part to a progressive shortening of durations which occurred in the course of experimentation, parallel with the decreasing novelty of the stimulus figures; in part to associations, minor distractions, and the like, which often came to light in the introspective notes.

The difference between the records of the two observers is considerable. For P. the images are more frequent and of shorter average duration, the mean variations larger, and the differences both between individual averages and between averages for the series greater. This greater range of variation is possibly correlated with the fact that P.'s general practice in observation was less extended, her attitude toward the experiment less stereotyped and more subject to disturbance than C.'s.

In spite of differences, however, the total durations for the two observers are not widely at variance, and the general rise and fall in values from series to series runs fairly parallel.

2. Duration and outline, complexity, etc. a. Outline. (Ser. I.) For duration of images, angular outlines have a slight advantage over curved (especially for P.). This is no evidence of any intrinsic difference in reproducibility of curves and angles, since both recur unsolicited. It seems rather to be a matter of the absence or presence of a number of definite points to attract and maintain attention during the reproduction period. Apropos of this, the observer remarks that in memory the margin and angles of the square and triangle stand out most distinctly, while in the disc the central portion is equally vivid with the margin. It seems, then, to be a matter of diversity against monotony in maintaining the attention.

b. Complexity. (Ser. II.) The duration averages for notched outlines stand in general above those for plain line contours. This does not, however, indicate any correlation between duration and extent of outline, for the observers report no tendency to follow the outline of the image with the eye. They do report a feeling of effort in the presence of the figures of Ser. II, a difficulty in grasping the whole, which is apparently the correlate of the attraction of the line of regard simultaneously to a large number of similar points, *i. e.*, the notches

on the margin. Hence, as with the angular figures of Ser. I, the factor determining duration would seem to be the incentives to involuntary attention offered by the image during the recording period.

c. Size. (Ser. III.) Increase in size is not paralleled by increase in duration of memory image. The one exception, in the case of size 4 (*O.* P.), is apparently due entirely to reinforcement through verbal associations, 'large' or 'larger,' in some cases, in others to direct comparison through recall of images of smaller size. This complication was apparently accidental, due to a faulty arrangement by which the series emphasized contrasts.

d. Color. (Ser. IV.) For both observers the general average for the color series is higher than that for the plain gray disc —, 2.3 sec. as against 2.2 sec. for C., 1.8 sec. against 1.1 sec. for P. This argues little, however, for the intrinsic reproductivity of color, since the single averages for two of the colors fall below the standard gray disc averages, while the lengthened duration of green is directly traceable to the presence of a persistent association formed during the period of exposure (*O.* C.). For *O.* P. the durations in the color series are subject to great variation, being more at the mercy of chance associations than in the case of the gray series. The ascendancy of yellow must be referred for explanation to the following heading (e), since P. reports that it is recalled as a brightness rather than as a color.— It is to be noted here that the colored discs are less reproducible and recordable as *discs* than are gray ones. They often fail to maintain a definite outline, returning as waves of color rather than as distinct images.

e. Brightness. (Ser. V.) An increase both in average duration and in frequency appears toward the bright end of Ser. V (especially noticeable in the record of *O.* P.) The one irregularity in the series is that of black, which is explained by the fact that with this disc a distinct whitish rim, due to an imperfection in the material, seems to have formed the main feature of the image. In general, however, both observers report that the reproduction of the duller shades of the series was less satisfactory, and, in their estimation, less accurate. This is possibly less a matter of direct correlation between reproductivity and the brightness scale, than of the relation of the different shades to the background in the exposure or reproduction period. The black screen and the darkened field of vision would throw the lighter discs into relief, while the darker discs might be less distinguishable from the background in reproduction. According to the laws of involuntary attention, the contrasting image would, of course, lay the stronger hold on the attention during the reproduction period. On the other

hand, the longer duration of the image for white may be related to the peculiar value of bright light as an incentive to the attention.

A word may here be inserted on the disturbing influence exerted by affective tone, contrast, and the like. Occasionally, the observer reports somewhat ambiguously, of a figure, "more pleasing," or "more interesting, hence easier to recall." As a matter of fact, we find that, both in total number of recurrences and in average duration for single images, C.'s favorite colors, blue and green, hold their own over all other figures except the notched square. This so-called 'pleasantness' is, however, largely reducible to richness of association.

The effect of contrast, novelty, and familiarity on the course of the images is indicated both in the record and in the introspective account of P. As a result, apparently, of repetition, the images of the standard size medium gray disk (which had a place in Ser. I, III, and V) declined in vividness, and toward the end of the investigation altogether failed on three occasions to appear at all. On the other hand, the image of the largest disc (Ser. III), which rarely failed to elicit surprise, and the qualification "large" or "larger," maintained throughout one of the highest duration values.

On the whole, then, so long as duration is made the criterion, the results do not warrant the hypothesis of any direct correlation between reproducibility and size, outline, color, etc., *as such*. It seems probable that these five factors are varyingly effective only in conditioning the attention bestowed on the figure (presumably during the period of reproduction), hence indirectly affecting the duration of the image. On the other hand, distinctness and completeness of image are, as the introspections indicate, less subject to disturbance from outlying factors, hence more purely indicative of the grade of reproducibility in any case.

The problem will, therefore, next be approached from the standpoint of these more significant factors, and their relation to duration examined.

III. *Completeness and Distinctness.* 1. Completeness. All the records show that completeness is not a function of duration. The briefest image may be as complete as that of lengthiest duration. Further, scrappiness of figure would seem to be correlated both with the direction of attention during exposure or reproduction (see I, 3), and with the narrowed range of attention in reproduction. The portions of the visual field lying in indirect vision in the world of perception, or occupying merely the margin of consciousness, seem, in the world of images, to be totally obliterated, or at most present only in the phantom form in which, in popular phrase, the old moon is

said to be present in the new moon's arms. This is illustrated by the report of both observers that when only a crescent out of a whole disc, or the corners of a square, were present in clear consciousness, they could not assert that the remainder of the figure was absent, seeming often to 'feel' rather than to see it.

2. Distinctness. After each record period, a note was made of the relative degree of clearness of the boundaries of the memory image, usually in the terms 'clear' or 'distinct.' Comparison of these observations with the corresponding time records shows that distinctness and duration do not run closely parallel. The individual times in the records reported "unusually distinct" are rarely longer than those for the same figure when reported indistinct. *E. g.*, in a record for the triangle reported "only fairly distinct," the images persist from 2.4 to 4.4 sec., whereas the average duration for that figure is only 1.4 sec. Again, in a record for the square reported as "clear and distinct," the times run from 0.4 sec. to 1.4 sec., while the general average for that figure is 1.8 sec.

At the same time it must be admitted that there is a pretty close relation between the *average* length of duration and the average degree of distinctness for any figure. Thus in P.'s record the figures yielding the longest average duration of image show, with one exception, the largest total of judgments 'distinct.' *E. g.*, the images of the triangle and of the square in Ser. I, the times for which stand at the head of the series, are alone almost invariably reported distinct. In Ser. II, the disc, which has the lowest average duration, has also the majority of judgments 'indistinct.' In Ser. III, size 1 receives the largest number of verdicts 'distinct,' and has also the highest average duration (with the exception of size 4, which is thrown out, on the ground of disturbing associations). In C.'s record this correspondence is less marked, average frequency rather than duration of image varying with distinctness.

It may also be noted in passing that, for distinctness as for duration, angular figures are in the long run more favorable than curved, or, more generally stated, complex are more favorable than simple.

On the whole, then, we may say that, while the distinctness of the individual image is not dependent on its duration, the fact that the image which is typically most distinct tends on the average to maintain itself longest in consciousness suggests two things. Either distinctness is one of the determining factors of duration, or—and this statement seems the more intelligible—both distinctness and duration are dependent on some more fundamental factor. That such a fundamental factor may be found in the capacity of the figure for securing auto-

matic adjustments of the attention during reproduction (or exposure) is suggested by two sets of facts. First, by the correlation existing between distinctness and duration, and complexity; secondly, by the correlation between variations in distinctness and duration for the same figure, and the presence or absence of such incentives to the attention as contrast, novelty, pleasantness, familiarity. When it is recalled that the image during the reproduction period is left entirely to the play of the involuntary attention, it becomes readily conceivable that distinctness is dependent primarily on the presence of one or more features in the figure (*e. g.*, an angle) capable of offering a point of support to the attention, secondarily on reinforcement through some central factor, associative or otherwise; that *duration* of single images is also determined in part by the number of component parts possessed by the figure, and capable of arousing interest in turn; and lastly, that *total duration* or frequency is dependent on distinctness as above determined and is hence a general exponent of the vitality of the image in reproduction. For instance, the square, which presents four definite points or features to the attention in contrast with the monotony of the disc, shows a more persistent tendency to outcrop in consciousness, a greater vitality in maintaining itself, and even when incomplete with reference to the original a greater definiteness of contour than any other member of the series (see Ser. I, *O.* P.).

Summary for Group I.

The data here collected are negative so far as any immediate correlation between duration or excellence of reproduction and any of the five peripheral factors here considered is concerned. All indications point rather to the significance of central conditions, either in the recording or in the observation period, as the critical factors in determining the character, duration, and frequency of the image. To these central conditions the peripheral factors stand in manifold and varying relations, thus indirectly affecting reproduction.

Group II. Involuntary Method with Eye-movement.

This variation of the procedure was undertaken in order to ascertain whether the introduction of eye-movements during the period of exposure would materially alter the typical results of Group I. More explicitly, the object was to determine whether a yielding to the natural tendency toward eye-movement during exposure, and the consequent increased tendency toward motor innervations during reproduction, would exert any influence on the distinctness, duration, or completeness of the image; and, if so, whether this influence varies with the

amount of movement. Group I was designed to test the relation of purely sensory factors to reproduction; Group II, that of the other peripheral factor, the motor element.

In this connection, two passages from articles to which reference has already been made may be quoted. Meakin, in more or less explicit support of the Münsterberg theory of the correlation of vividness with the discharge of motor cells, observes that "the mental tracing of a particular boundary seems to condition the sense of the corresponding contents;" and again, "the effect of the activity of the motor elements of the internal impression is to increase distinctness and prolong duration; the sensory processes standing in intimate dependence on the motor." Slaughter's statement, in his study of mental images, is, while somewhat ambiguous, substantially similar. The factors which keep visual images in clear consciousness are, he says, "their own internal organization closely combined with motor elements." Whether these statements are valid or accurate except under peculiar conditions of experimentation is a question on which the following experiment may throw light. It may, however, be suggested in advance that the question whether motor innervations *per se* condition the presence or distinctness of images would seem to be beyond the reach of ordinary introspective methods. For in so far as any correlation between vividness and innervation is open to observation, *i. e.*, when the kinæsthetic elements corresponding to the latter rise above the limen of sensation, it is obviously open to question whether these sensations do not themselves constitute the reinforcing factor.

It may here be noted that the results already obtained show a correlation between vividness and innervation, but only through the medium of the sensations attendant on innervation. These sensations are, moreover, only those accompanying fixation, hence common to all the figures, and apparently varying only in intensity. That is, there is no exact correlation between the character of the innervation and the outline of the figure, such as a theory like that of Meakin's presupposes. It was thought possible, however, that the previous conditions of experimentation, *i. e.*, rigid fixation, might have been unfavorable to the setting up of the necessary associations, and hence to the highest possible grade of distinctness. The procedure with free eye-movement might, on the other hand, be expected to yield a definite correlation between extent or complexity of outline, and duration or distinctness, if such correlation exists.

A. With the Figures of Group I.

METHOD.

A set of more or less tentative observations was taken with

each observer, the directions being freely to explore the outline of the figures presented. The figures used and the general order of experimentation were as in Group I. A full introspective account of each minute's record was kept. For purposes of comparison a single set of observations with fixation, with similar pauses for introspection, and at about the same stage of familiarity with the figures, was given.

RESULTS.

TABLE II.

	Obs. C.								Obs. P.							
	Eye Movement.				Fixation.				Eye Movem't.				Fixation.			
	(1) Av. dur.	(2) No.	(3) Av. dur. for ser.	(4) Av. dur. for set.	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
I. Disc	2.7	4	2.2	2.1	2.1	4	2.3	2.2	1	5	2.2	1.5	1	6	1.3	1.7
Ellipse	1.8	5			2.6	3			2.7	5			1	4		
Square	2.5	4			2.3	5			1.7	8			.7	9		
Triangle	2.1	4			2.3	5			3.7	4			2.6	4		
II. Disc	2.1	5	2		3.3	3	2.6		1.1	8	2.5		.9	7	1.2	
Ellipse	2.1	5			2.6	4			6.9	4			2.3	5		
Square	2.2	5			2.1	4			1.8	9			1	7		
Triangle	1.7	4			2.4	4			.3	4			.8	9		
III. Size 1	2	5	2		2.1	5	2.1		.9	9	1.1		.5	10	1.2	
2	2.3	4			2.2	4			1.2	6			.4	3		
3	2	3			2.1	4			1.1	7			.4	8		
4	2	2			2.2	3			1.2	8			3.7	6		
IV. Red	2.5	4	2.4		2.5	4	2.2		.9	7	.8		1.3	1.2	2.9	
Blue	2.9	5			1.6	6			.5	5			2.5	6		
Green	2.1	4			2.4	4			1.1	6			4.3	5		
Yellow	2.2	4			1.3	5			.6	8			3.7	3		
V. White	2.5	6	2.2		1.9	5	2.1		.3	6	1.2		.8	8	2.2	
Light gray	2.3	5			2.3	5			3.9	4			3.1	5		
Med. gray	2	5			2.5	4			.2	3			2.6	6		
Black	2.1	5			1.9	4			.6	4			2.4	8		

Columns 1, 2, 3, and 4 give the average duration of single memory images, number of images per minute, average duration of image for series, average duration for five series, respectively.

I. The five factors in relation to distinctness and duration. There is even less evidence of any proportionality between duration or distinctness, and size, brightness, amount of outline, etc., than in Group I. None of the five factors seems to have any intrinsic value in reproduction.

II. Movement *versus* fixation, in relation to duration and distinctness.

1. Duration. Comparing the results from the two sets, we find the average duration slightly longer for the procedure with fixation,—1.7 sec. as against 1.5 sec. for P., 2.2 sec. as against 2.1 sec. for C. The average duration for Ser. I and II for P., and for Ser. IV and V for C., is, however, shorter for fixation than for eye-movement, showing no uniformity for the two observers in the alterations effected by eye-movement.

2. Distinctness. The introspective evidence for the two observers is more in accord. First, for distinctness and completeness of image the advantage is with the method of fixation. Secondly, the cases of lengthened duration with eye-movement are correlated, not with greater stability of image, but with the tendency to explore the margin, and with the successive appearance and disappearance of the component parts of the figure. With the new procedure, moreover, the localization of the memory image is less definite, more often to one side of the point of fixation; while the image itself is less stationary, and often seems to float across the field.

These results seemed, on the whole, sufficiently promising to warrant a repetition of the procedure under more favorable conditions; namely, with a set of figures free from the habitual fixation associations of the former method.

B. With New Figures.

MATERIALS.

The new series consisted of four figures, of the standard gray tones, of approximately equal surface, and as little suggestive of definite associations as possible. The series was as follows:

1) Pentagon.
2) Octagon.
3) Rectangle.
4) Quadrilateral. (An elongated diamond.)

This series was given twice each observation period, once with fixation and once with freedom of eye-movement during the four seconds' exposure. Steady fixation was facilitated by the use of a head rest. There was also a slight alteration in the manner of exposure, the observer closing his eyes for a second during the removal of the screen, in order to lessen the tendency to eye-movement on exposure. Further, the record of the course of the images was begun five instead of twenty seconds after the exposure of the figure, it being thought desirable to make use of the images which always occurred during this pause, and trial having indicated that the observer could practically abstract from the appearance of the sensory after image. Four repetitions of the whole procedure were given with observer C. only.

RESULTS.

TABLE III. OBS. C.

	Eye Movement.						Fixation.					
	(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) Tot. dur. for ser.	(6) Av. dur. for ser.	(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) Tot. dur. for ser.	(6) Av. dur. for ser.
Rectangle,	40.7	2.2	.5	4.5	166.2	2.1	38	2.1	.4	4.5	150.1	2
Quadrilateral,	49.4	2.1	.3	5.6			36.8	2	.3	4.5		
Pentagon,	38.2	2.1	.3	4.5			35.7	1.7	.3	5.2		
Octagon,	37.9	2.1	.3	4.5			39.6	2.3	.4	4.2		

In the above Table columns 1 and 5 give the total duration of image for each figure and for the series as a whole (for four observations); 2, the average duration of image; 3, the mean variation; 4, the average number of images per minute; 6, the average duration for series.

I. *Introspections.* (For eye-movement.) 1. Incentives to reproduction. Occasionally the image seems to be overlooked by some chance eye-movement, as in winking. Moreover, eye-movements, actual or imaged, play a considerable part in the maintenance and completion of the image.

2. Localization. The memory image is more patchy, illusive, and oscillatory, than in the procedure with fixation. The space relations of the image are less definite (as noted in A.), and the image is more often of the 'subjective' type, with the sensations of fixation lacking. The best, most definitely localized images were obtained only when C. had become sufficiently practised with the material to sweep the figure with his eyes, and have left a fraction of the four seconds of exposure for fixation. This device seemed to come to him naturally as a means of escape from the feeling of dissatisfaction attending a mere cursory exploration of the margin.

3. Distinctness and completeness. In general, the images are described as less clear and definite and less complete than in the procedure with fixation, the pentagon and octagon being especially defective. In the most distinct, portions only are clear. Thus the angles only of the rectangle are clearly defined, the intermediate line and surfaces being hazy or absent, while in the quadrilateral the upper acute angle only may be definite.

II. *Duration and Frequency.* 1. Duration of image for

fixation and eye-movement. Comparison of the general averages shows a slight advantage in favor of the procedure with eye-movement, 2.1 sec. as against 2 sec. This (as noted in A) is correlated with the tendency of the image, in the procedure with eye-movement, to rush across the field in indistinct patches, or to build itself up, bit by bit, by real or imaged eye-movement. The averages, also, for individual figures show a longer duration for the eye-movement procedure, except in the case of the octagon. The latter shows a duration of 2.3 sec. for fixation as against 2.1 sec. for eye-movement.

3. Duration in relation to distinctness and completeness. The higher average duration for the procedure with eye-movement is associated with an actual decrease in the distinctness and stability of the image. There is, moreover, no precise correlation between distinctness and completeness, and duration, in the case of any single image. Nevertheless, the rectangle (in the procedure with eye-movement) shows a greater total of judgments 'distinct' and 'complete,' and at the same time a slightly higher *average* duration than any other member of the series. Hence, as in Group I, we may conclude that duration and distinctness, while practically independent of each other, are both furthered, though not absolutely determined, by the same general conditions. The exact nature of these conditions may be brought out more fully in connection with Group III.

Summary for Group II.

1. The appearance of the image in consciousness is not necessarily dependent on the conscious 'mental tracery' of its boundary. Indeed, under conditions of observation or experimentation which tend to produce such a dependence, the character of the image as a whole is impaired, and the simultaneous appearance of its parts hindered.

2. Fixation during exposure affords the more favorable condition for reproduction,[1] either for the reason that it secures a more impartial distribution of the attention over the figure, hence a clearer impression of the whole, or for the reason that, through the association thus set up between the retinal image and the sensations involved in fixation, these sensations, when repeated or reproduced with the image, constitute a more potent reinforcement of the image than could the fleeting sensations producible by irregular or transitory ocular movements. In short, it is not general ocular movement, as Meakin implies, but certain special motor accompaniments of the state of visual attention, which contribute the effective conditions of visual reproduction.

[1] At least in the case of figures of the size here employed.

Group III. Voluntary and Involuntary Method with Fixation.

The object of this set of observations was, first, to repeat in more specific fashion the test of the relative effectiveness for reproduction of figures of curved and angular outlines, of relative simplicity or complexity, and of smaller and larger size; secondly, to determine whether the constant differences in duration and distinctness of memory images of different figures are attributable to differences in the incentives offered by the figure to passive attention (during the period of reproduction), or to conditions relatively favorable or unfavorable to reproduction, established during the period of exposure and intrinsic to the image of any particular figure. That is, it was desired to ascertain whether the observed differences between memory images of different figures were intrinsic and necessary, or merely peculiarities resulting from the involuntary procedure thus far adopted in the reproductive period.

MATERIALS.

Three new series were prepared, each consisting of four similar figures, of the standard gray tone, and of graded sizes, each figure being approximately double the size of that preceding. Series I was made up of discs, Series II of triangles, Series III of discs like those of Series I, in which were inscribed (in Indian ink) triangles similar to those of Series II. It was especially desired to eliminate, so far as possible, any disturbances from familiarity and contrast effects, or from associations. Hence the triangle used was an isosceles with an acute vertex, in place of the equilateral used in Group I; and the figures in each series were given in regular, not haphazard sequence, size 1, 2, 3, 4 in turn, in order to lessen contrast.

METHOD.

The procedure was in general similar to that in Group II B., except that the procedure for eye-movement was omitted, and voluntary alternated with involuntary recall. Records of voluntary recall of images for one minute were taken for the whole set of figures, alternating with similar records for involuntary reproduction. The whole set of three series was given in a period, twice in all for each procedure, voluntary and involuntary. One observer only, P. of Group I, was employed.

A few supplementary observations were taken with voluntary recall of a single image, after each exposure. Half were given with fixation, half with eye-movement during the four seconds of exposure. In these the results tallied with those obtained by the ordinary method of recording so far as distinctness,

completeness, and ease of recall are concerned. Moreover, differences parallel to those of Group II were observable in the results for fixation and eye-movement.

TABLE IV. OBS. P.

		Involuntary.						Voluntary.					
		(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) Tot. dur. for ser.	(6) Av. dur. for ser.	(1) Tot. dur.	(2) Av. dur.	(3) M. V.	(4) Av. No.	(5) Tot. dur. for ser.	(6) Av. dur. for ser.
I. Circles	1.	28	1.4	.5	9	95.7	1.8	83.2	4.6	2.1	9	203.9	2.7
	2.	11.8	1.1	.5	5			41.3	2.1	1.2	9.5		
	3.	28.8	3.2	2.2	4.5			41.5	2.4	1.6	8.5		
	4.	27.1	1.7	.8	8			37.9	1.8	1	10		
II. Triangles	1.	16.8	2.1	1.9	5.2	73.1	2.3	80.4	7.3	2.4	5.2	240.5	4.1
	2.	8.3	1.1	.7	7			65.9	4.7	1.3	7		
	3.	17.8	4.9	4	2			33.8	1.8	1	9		
	4.	15.8	1.2	.5	5.2			60.4	2.7	1.4	11		
III. Inscribed triangles	1.	32.2	2	1.2	8	155.1	2.3	72.9	3.8	1.4	9	240.3	3.1
	2.	39.6	2.6	1.4	7.5			56.4	2.2	.7	12.5		
	3.	45.6	2.6+	1.3	8.5			58.9	3.2	1.2	9		
	4.	37.9	2.2	.9	8.5			51.8	3.2	1.3	8		
						Gen. av. 1.1						Gen. av. 3.3	

In the above Table columns 1 and 5 give the total durations of image for each figure and series, respectively; 2 and 3, the average duration of image and mean variation; 4, the average number of images; 6, the average duration of image for series.

RESULTS.

I. *Introspections.* 1. The incentives or aids to reproduction employed in voluntary recall are: verbal idea of size; recall of some striking feature (as the angle of the triangle, or the black line in Ser. III), with slow construction of the image about this; movement of the eyes toward the point where the object was seen; and, above all, steady fixation.

2. Discs were more difficult to recall than triangles, or discs with triangles inscribed. In the latter figures, the triangles are more distinct than the surrounding segments.

3. The percentage of judgments "distinct" and "complete" for each series is as follows:

	Involuntary.		Voluntary.	
	Distinct.	Complete.	Distinct.	Complete.
Series I.	60%	12%	75%	37%

	Involuntary.		Voluntary.	
	Distinct.	Complete.	Distinct.	Complete.
II.	75%	37%	64%	60%
III.	37%	00%	37%	12%

II. *Relative Effectiveness for Reproduction.* The three points to be tested will be examined here, differences in involuntary and voluntary recall being abstracted from.

1. Curves and angles. The triangle has in general the advantage over the disc, in duration, completeness, and distinctness of memory image, as the Table shows. It is, also, as noted above, more readily recalled, and in Ser. III is usually the most positive part of the figure. That this is less a matter of curves and angles in themselves than of complexity as against simplicity, or of varying incentives to fixation, is indicated here as in the previous groups of experiments.

2. Size. The duration, distinctness and completeness of the memory image are not proportionate to the size of the figure reproduced. For involuntary reproduction the next to the largest size invariably overtops the series, both for individual and for total durations. It is noticeable, however, that the corresponding images are reported incomplete, and only moderately distinct. For voluntary recall, the image of the smallest figure maintains itself longest in consciousness. In both procedures (and this seems to be the significant item), the memory image of the smallest figure excels all others both in distinctness and in completeness. Evidently there is, then, an optimal size in visual reproduction, related either to the retinal area of clearest vision, or to the limited field of vision in reproduction.

3. Complexity. The complicated figures of Ser. III have a very slight advantage over the simpler figures (Series I and II) and that mainly in the number of images to the minute. This advantage is partly to be attributed to the fact that in successive images different parts of the figure were accustomed to appear, thus placing the reappearances on a standing different from that of ordinary repetitions. For average duration these figures stand on a level with the triangles in involuntary recall, below them in voluntary. What is more significant, both in distinctness and completeness they rank decidedly below the other figures. But while in this case complexity seems to exercise an unfavorable influence on reproduction, on taking the triangle as an example of relative complexity in comparison with the disc, we find our conclusions reversed. Hence, we conclude that the complexity of the figures of Ser. III exceeds either the limits within which a figure is easily grasped during four seconds' exposure, or the limits of the range of attention for reproduced sensation.

In summary, then, we may say that the figures of small size and of moderate complexity offer the conditions most favorable to reproduction. Whether these conditions are effective during the period of observation or reproduction, or both, must now be considered.

III. *Differences in Reproducibility in Voluntary and Involuntary Reproduction.* With voluntary recall there is a general redistribution of values, with regard to duration, distinctness, and completeness, for the three series. Since, however, this redistribution fails to reduce the memory images of the three types to the same level, and, moreover, reproduces most of the distinctions noted for involuntary recall, the conjecture advanced in Group I, that the superior reproducibility of a figure is due to some intrinsic or accidental qualification for securing a better adjustment of the passive attention during the period of reproduction, seems insufficient to explain the facts. That is, maximal attention during observation is not as uniformly effective for reproduction in the case of figures as in the case of simple sensations, but is complicated by the relation of the figure to certain central conditions. This inequality in the relations of different figures to the central conditions is one that asserts itself under conditions of voluntary as well as involuntary attention, *i. e.*, during either the period of observation or of reproduction. This inequality must now be more closely examined.

It is first to be noted that in Group III, as also in I and II, constant differences in reproducibility are correlated principally with "complexity" of figure. That the image of the more complicated figure should, either in voluntary or in involuntary recall, remain relatively longer in the focus of consciousness than that of the simple figure might be expected if we were to reason by analogy with conditions existing in perception. Gordon [1] has shown that the duration of a single pulse of attention is longer for a complex than for a simple visual object. It is possible that this rule obtains also in the sphere of reproduced sensations, and that the longer durations of Series III (especially in the voluntary procedures where the interruptions in the appearance of the memory image have often the character of fluctuations) are further expressions of this rule. Yet the fact that the most complex figure (that of Ser. III) does not give the longest memory image warns us that this function of complexity is not to be accepted without limitations. The existence of an optimal complexity for reproduction indicates that it is not complexity itself, but the extent to which it

[1] K. Gordon: Meaning in Memory and Attention, *Psych. Rev.*, X, 267.

affords conditions favorable to fixation and attention, which is the determining factor. Moreover, the above quoted facts on the pulse of attention would hardly lead us to anticipate that the image of a complex figure would be not only longer, but also, within certain limits, more complete and distinct than those of other figures. Hence, it seems necessary that the facts be analyzed further in order to arrive at the precise nature of the advantage conferred (in certain cases) by complexity.

Let us look first at the period of exposure for some influence exerted in association with complexity either to enhance the neural excitation underlying reproduction or to furnish associated factors which may serve to reinforce the reproduction. The sensations arising from the innervation of the muscles used to inhibit those eye-movements to which the corners of the figure form incentives seem to offer precisely the factor required. The introspections show a tendency to movement, which is felt and resisted, both in the period of exposure and of reproduction, and which bears a significant relation to the presence and distinctness of the image in the latter period. Since with the simple disc there is apparently no corresponding tendency or resistance, it seems probable that the difference in distinctness and duration of the triangle as compared with the disc is due to the presence in the visual complex of associated fixation sensations of greater intensity, set up again on the appearance of the retinal image in memory, and acting as a reinforcement of this image. In brief, the figure which gives rise to the clearest and strongest fixation sensations has, other things being equal, the best chance in reproduction.[1]

The doubt may of course be raised as to whether these kinæsthetic sensations are actually reinforcing factors, or merely coefficients of the efficiency of attention. The weight of evidence, however, throughout all these groups of experiments, seems to lie on the side of the former hypothesis.

Summary for Group III.

1. There is an optimal size and complexity for visual reproducibility, dependent on the range of atttention.

2. Conditions obtaining in the period of exposure are critical for reproduction, since certain differences in reproducibility are constant both in voluntary and in involuntary recall.

3. Along with various central factors (familiarity, contrast, association and the like) conditioning the appearance and dis-

[1] *Cf.* Wilhelm Peters: Aufmerksamkeit und Zeitverschiebung in der Auffassung disparater Sinnesreize, *Zeitschr. f. Psych. u. Physiol. der Sinnesorgane*, Bd. XXXIX, 1905, 427, for the value of fixation elements in visual attention.

tinctness of the image, the kinæsthetic elements of fixation play an important rôle.

The results of the investigation may be summed up as follows:

Neither the attributes of the stimulus, qualitative or spatial, nor the general ocular movements to which these attributes may give rise, constitute the important differential factor in visual reproduction. On the contrary, reappearance and persistence, distinctness and general accuracy of reproduction are conditioned primarily upon the relation of the stimulus or image to central conditions, and upon certain special motor phenomena accompanying fixation.

FURTHER STUDY OF THE ENGLISH SPARROW AND OTHER BIRDS.

By JAMES P. PORTER,
Instructor in Psychology, Collegiate Department, Clark University.

		PAGE
I.	Introduction,	
II.	Description of Birds Experimented with and Work Done by Others,	249
III.	Tests with a Simple Maze,	252
IV.	Memory Tests,	255
V.	Experiments, with a Food-box, on a Cowbird and Pigeons,	257
VI.	Memory Tests,	262
VII.	Tests with Designs,	264
VIII.	Experiments on Color Discrimination,	265
IX.	Affective and Volitional States,	266
X.	Summary,	269

INTRODUCTION.

In an earlier paper on "The Psychology of the English Sparrow" the writer committed himself to the further study of the same and other species. Like most programmes, perhaps always more or less unwisely made, this has seemed tardy of fulfillment. For experimenting with such frail and nervous animals one must have an unlimited amount of time and the possibility of making the surroundings very free from disturbing noises, etc. It is scarcely necessary to say that neither of these conditions could be fully satisfied. The birds have been kept and the experiments tried in a large animal room with alligators, white rats, and Jack the monkey, in other cages near by. These were often a disturbing factor while an experiment was in progress. Then, too, the necessity of carrying along simultaneously the same test with a number of birds led to a change in the method from that used earlier; at least, during the first experiments. To do this each bird was kept in a small cage outside the large one (the latter being twelve feet long and wide and six feet high). When tests were made these cages with the birds were carried inside the large one. Later they were allowed to go directly from the small cages into the large one. This latter method it seems to me is much better as it eliminates the fright which always results from carrying the small cage and the birds become more accustomed to the large cage. They are not suddenly confronted with so

much that is new and consequently there is less distraction. Notwithstanding the fact that the same precautions as to food, air and sunshine, have been taken as in the earlier study I have found it difficult to keep the birds in good condition for any great length of time. Since from the first I was on the sharp lookout for abnormal conditions of any kind, allowance will be made for these in the interpretation of results.

Description of Birds Experimented with and Work Done by Others.

The birds experimented with were a Vesper Sparrow, a female Cowbird, a male Dove-cot pigeon, a female Passenger pigeon, and some half dozen English Sparrows. The results of a few tests on a Red-headed Woodpecker will also be described. Some facts by way of description of the species, their habits and habitat, and of interest chiefly from a psychological point of view, will now be given.

The Vesper Sparrow, Grass Finch or Bay-winged Bunting is somewhat smaller than the English Sparrow and not so strongly or roughly built. According to Chapman (1, p. 141, and facing p. 122 for picture) its habitat is the great broad fields where it finds its food. It is protectively colored, the upper parts being grayish black and brown; breast and sides streaked with black and brown; belly light; lesser wing coverts chestnut. It has a very sweet song, some parts of which as well as the sharp, clear calls were to be heard in the laboratory. Its habit of feeding and flying near the ground is so strong that it required some patience and several trials to get it to leave the large cage by an opening in the upper corner. Its scratching habit was so persistent that to the last, after months of captivity, no food could be kept in its food-box.

From the standpoint of its habits and instincts the Cowbird is one of the most interesting and hated of birds. It is somewhat larger than the English Sparrow, being rather an obscure looking bird of dusky grayish-brown color. This is particularly true of the female. See Chapman (1, facing page 114) for colored picture. Like the European cuckoo it builds no nest of its own but lays its eggs in other birds' nests. According to Coues (2, p. 402), "it is migratory, abundant, gregarious, polygamous, polyandrous, and parasitic. . . . It appears to constitute, furthermore, a remarkable exception to the rule of conjugal affection and fidelity among birds. A wonderful provision for the perpetuation of the species is seen in its selection of smaller birds as the foster-parents of its offspring; for the larger egg receives the greater share of the warmth during incubation and the lustier young Cowbird asserts its precedence in the nest; while the foster birds, however

reluctant to incubate the strange egg (their devices to escape the duty being sometimes astonishing), become assiduous in their care of the foundling even to the neglect of their own. The number of species thus imposed upon is now known to be about one hundred. In the western prairies great flocks of this bird may be seen following herds of cattle. They very often feed upon the parasitic insects found on the backs of these cattle. When kept in captivity with other birds the Cowbird, according to Prof. C. F. Hodge and Mr. Raymond, performs the same good office for them. My Cowbird I have never seen do this, but she had the habit of approaching quite near to the English Sparrows and looking them over very carefully. Does this act relate itself to the food-getting instinct or does it have its setting in the friendly stealthy attitude and approach which this bird has in order to lay its eggs in other birds' nests? Another very interesting performance was the turning of her head on one side and moving it round as though to take in the whole expanse of sky. She did this most often immediately after alighting. This has not been seen in other birds which I have observed. It would seem to find its explanation in the necessary watchfulness she must exercise in order to deposit her egg in the nests of other birds without being seen.

The Pigeon is so familiar that just a word of description will suffice. Schmeil (12, p. 195) writes as follows: "The races of our domestic pigeons are the descendants of the rock-pigeon which inhabits the cliffs of the coasts of the Atlantic and Mediterranean and other similar places. It has been domesticated from times immemorial. By means of constant selection numerous races or varieties of pigeons have been produced which frequently exhibit in shape, color, formation of beak, feet, etc., more considerable differences than distinct species of birds. The pigeon has a keen sense of sight. It is a defenceless bird and is consequently *shy* and *timid*." Yet in this respect Professor Mills (6, p. 257) makes a difference between the different varieties of pigeons. He says "though differences between the mature forms of varieties of pigeons, so pronounced as regards physical form, less so psychically, but still real and always present, are obvious to even a superficial observer, it is interesting to note that even at an early date such differences do appear. To illustrate: the Dragoon is a bird of very bold appearance, and as compared with many varieties, is somewhat wild. It has been spoken of as the 'game bird' of the pigeon family. Such characteristics are manifest in the young before they are twenty days old. They peck sooner and more vigorously in the nest. They are shyer of approach, etc. This cannot be explained by a more rapid

development, for several other varieties mature sooner than they do."

The English Sparrow and its habits are, like the pigeon, so familiar that it needs but little description. For this the reader is referred to my earlier paper (9, pp. 313-316).

A few words will suffice to set forth all that has hitherto been attempted in the investigation of the psychical differences between birds of the same or different species. Professor Whitman (15, pp. 331-338) has made experiments which point to a difference in intelligence between the three varieties of Pigeons —the Homing, Ring-neck, and Dove-cot. The first experiment consisted in placing the egg just outside the nest. Would they have intelligence enough to modify their instinctive way of reacting and thus pull or try to pull the egg back into the nest? The Passenger Pigeon recognizes, not by sight but by feeling, that something is wrong. Her instinct being keenly attuned she promptly leaves the nest. The Ring-neck may try to reclaim one egg. Having done so she is satisfied. The Dove-cot tries to reclaim both eggs and failing leaves her nest with more hesitation than the others.

Here, then, according to this author, is a difference between the power of intelligent action to be found in these birds. The reason for this difference, according to Prof. Whitman, lies in the fact that domestication has let down the bars to alternative choice. And this means the beginning of intelligent action. The wild or semi-wild pigeon has always nested in a place where it has never recovered its eggs after they were once out of the nest. With the domesticated pigeon conditions have been different. It could reclaim its egg.

Prof. Whitman also notes that the Ring-neck has great difficulty in locating her nest-box even though it has been moved but little out of its accustomed place and everything else remains the same. She depends entirely on its relations to the environment.

The above constitutes the sole experimental contribution, so far as the writer's knowledge goes, to the mental differences between birds. Whether or not we agree that Prof. Whitman has placed the correct interpretation upon the fact which he has found is a question aside. However, we are able to see that he finds by experiment and observation that there are these differences in intelligence and variability of instinct between his three varieties of pigeons. Domestication and semi-domestication are responsible, according to him, for these differences. Now, no one will question the statement that the English Sparrow has been for thousands of years in just as favorable, indeed, if not more favorable, conditions with relation to domestication. As stated in a former paper, it has

retained its native wildness, and yet lives with man, compelling the latter, in spite of his efforts to the contrary, to feed it and give it shelter. That these are good conditions necessary for the development of variability or alternative choice there can be little doubt. Apropos of an investigation into the mental differences between birds not only into the cognitive but the emotional and volitional as well, the following from Chapman (1, p. 137) is not without interest,—"Even after leaving the nest the parasite (the cowbird) continues its call for food, and when seeing a Maryland Yellow Throat, or some other small bird feeding a clumsy fledgling twice its size, one wonders it does not detect the deception. The better we know birds the more strongly are we impressed with their individuality. To one who has no friends in feathers it seems pure fancy to endow some insignificant "chippy" with human attributes; but in reality there are as clearly defined characters among birds as among men. To be convinced of the truth of this statement we have only to compare the Cowbird, a thoroughly contemptible creature, lacking in every moral and maternal instinct, with the bird who constructs a well-made nest, faithfully broods her eggs, and cares for her young with a devotion of which mother love is alone capable." What additional evidence can controlled observation and experiment offer as to mental differences among birds?

Tests with a Simple Maze.

After making several trials with Dr. Small's complex maze, a reduced form of which was used in my earlier work, I concluded that it was too difficult for a beginning test as well as too great a tax upon my time, a single test sometimes requiring as much as four hours' time. Accordingly a simple maze was made. Fig. 1 shows the plan of this maze which was four feet square with alleys five inches wide and high. The bottom and top were of the same wire mesh both being cut away at C, the centre, leaving this open. The partitions and sides were fastened by unravelling the wire mesh of the edges and clinching these into the top and bottom along their entire length. This maze is therefore very free from landmarks but since it is so simple this is not of so much consequence as in the more complex one. It will be seen that there are two longer ways, and one short one, to the centre. The maze was placed in the middle of the floor of the large cage and food at C. The small cages were placed with open door at O, the opening to the maze. After reaching C the bird was free to eat and fly about in the large cage. There were thus two incentives to cause the birds to put forth greater efforts in order to get to C; namely, the desire for food and for the greater freedom afforded

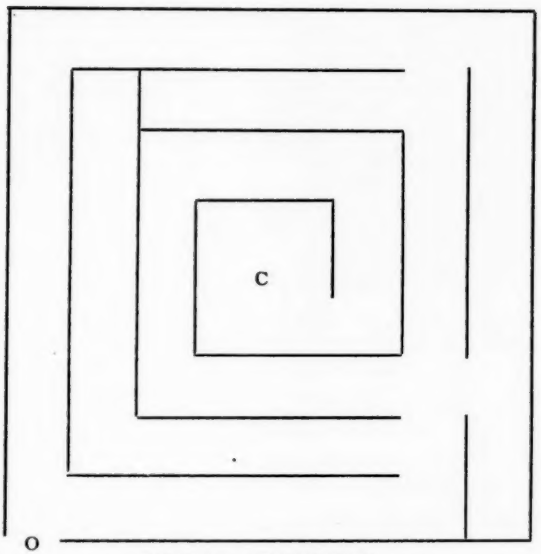


FIGURE I. SIMPLE MAZE.

by the larger cage. The birds were recaptured by hanging the small cage with open door on the outside of the larger one and carefully driving them through a small door in the upper corner of the larger cage. Six different birds were tested with this maze. Each approximately the same number of times daily. The birds were a Vesper Sparrow, a female Cowbird, two male and two female English Sparrows. The table following shows the results for a series of thirty tests, the numbers under "Time" and "Errors" being averages of each two consecutive trials. The time is given in seconds and an error means a retracing, no matter how slight, in the wrong direction or toward the starting point. A record of the path taken by the bird was made by tracing a line through a reduced plot which I held in my hand. F means failure. F–F means failure both trials of the first two tests of the Cowbird. F–880 indicates that there was a failure the third trial and the fourth trial required 880 seconds. Other cases so indicated are to be interpreted in like manner. Ch. indicates the number of reversals from the short to the long way or *vice versa*.

The Cowbird and a male English Sparrow failed to get through the maze during the first trials. Their claws seemed to hook round the wire in the floor of the alleys so that they

TABLE I.

Tests with Simple Maze.[1]

No. of Trial.	VESPER SPARROW.		COWBIRD.		ENGLISH SPAR'OW. F.5		ENGLISH SPARROW. M.6		ENGLISH SPAR'OW. F.7		ENGLISH SPAR'OW.M.8	
	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs.	Time.	E'rs
1–2	44	3·5	F–F	91	116	7·5	F–504	58–45	645	121	130	11
3–4	112	3·5	F–880	F–27	32	1	59	2	133	13	91	7
5–6	30	1	231	44	36	1·5	56	0	78	6	20	2
7–8	44	4	F–420	6	170	7·5	68	4·5	16	·5	14	1
9–10	31	·5	F–57	7	12	0	36	0	14	1·5		
11–12	26	1	27	1	22	1·5	13	0	11	0		
13–14	43	8	13	1	88	0	13	·5	11	1		
15–16	39	3·5	12	1·5	98	2	7	·5	7	1		
17–18	13	1	6	·5	16	0	124	2	14	0		
19–20	26	2.5	8	2	14	·5	10	0	9	0		
21–22	10	0	6	·5	7	0	15	·5				
23–24	8	·5	5	·5	13	0	9	0				
25–26	11	·5	7	·5	23	1·5	7	0				
27–28	9	1	4	0	9	·5						
29–30	13	1·5	5	·5	9	·5						
Ch.	15		2		3		1		2			

[1] In this and all following tables the *time* is given in seconds.

had considerable difficulty in getting along at all. It will be seen that the English Sparrow overcame the difficulty more rapidly than the Cowbird. The fact that the latter's claws are more hooked may very well account, in part, for her greater difficulty. Results from other experiments would agree with this. She probably is also less rapid in adapting herself to new situations. Her later progress in learning the maze, as indicated by the table, shows that it was probably nothing more than a late start.

The Vesper Sparrow, during all the trials, and especially during the first one, seemed most at home of any of the birds. To one who knows the native haunts and habits of this bird this has seemed surprising. But from a bird that lives and nests near the ground amid thickets and clumps of bushes this is just what I should expect. Her habit of staying very near the ground was shown very clearly when I tried to drive her from the large to the small cage. She persisted for some time in flying about near the floor. Furthermore, the Vesper Sparrow was throughout less easily frightened than the others. This would be an advantage to her during her first trials in the maze. She, the Cowbird and the English Sparrow, No. 7, became quite tame as the experiments progressed. The Cowbird wanted to come through the maze before I could get out of sight. But the tameness of the English Sparrow was probably due to his abnormal condition as he died a few days later. On the contrary, the female English Sparrow, No. 5 (which I

pronounced to be a young one, judging from the yellow bill, the color of her feathers, and her size), became very much frightened, and at the slightest disturbance she would crouch at some place in the maze instead of going through. Her fright was caused by her escape into the large room from the small cage. She had to be caught and this was done only after a prolonged chase. English Sparrows learn much more readily than other birds to take advantage when the small door is opened. Her wariness was shown by the time she remained in the small cage before entering the maze at all. This was considerably greater and more persistent with her than with the others. A later series with this same bird was discontinued on this account.

A glance at the table will show that all of the birds learned the maze during the twenty or thirty trials. All of them did not take the short way through, but if some habitually went the long way this did not lengthen the time much and should not be counted against them. But if there were many reversals from the long to the short way and *vice versa* then this should be noted since it would seem to indicate either a failure to discriminate or, what is more probable, an incapacity to hold in memory the way last travelled. The Vesper Sparrow made thirteen such reversals in thirty trials, the Cowbird three, the female English Sparrow, No. 5, four, the male English Sparrow, No. 6, one, and the male English Sparrow, No. 7, two such reversals. These reversals with the Vesper Sparrow grew less frequent toward the last of the series. Taking the results just mentioned in connection with the reduction of the time required and the number of errors, the Vesper Sparrow would seem to have the poorest record of any. If there is any difference between the Cowbird and the English Sparrow it is slightly in favor of the latter, particularly at the start. This is not so noticeable in the time as in the number of mistakes made. One reason for the Cowbird's short time is that she chose the most direct way and went very rapidly.

It can be seen from the table that the number of errors does not always increase with the time. The early adaptation of all these birds, and, according to these results, especially of the English Sparrow, is one of the chief points of interest. Many of the errors were very slight, and although they were corrected at once, record was always made of them. Habit seemed to hold them to their mistakes just as it does with us, and recognition of a certain part of the maze through sight or muscular sense, or both, seemed to be the cue for retracing their steps.

Memory Tests.

Following an interval of thirty days a series of ten memory

tests was made with three birds, the Vesper Sparrow, the Cowbird and the female English Sparrow, No. 5. There were no intervening tests and all the conditions were as nearly as possible the same as for the initial series. The results are given in Table II which is to be interpreted in the same manner as the table preceding.

TABLE II.

Memory Tests with Simple Maze.

No. of Trials.	VESPER SPARROW.		COWBIRD.		ENGLISH SPARROW. Fe. 5	
	Time.	Errors.	Time.	Errors.	Time.	Errors.
1–2	17	1	7	1	17	1
3–4	49	1·5	4	0	10	5
5–6	26	2·5	5	0	15	1
7–8	7	·5	7	·5	19	5
9–10	13	·5	4	0	9	0

The results in this table show that birds have a very good memory. The Cowbird shows the best results, her average time for the memory tests being the same as for the last ten trials of the first series. There are also fewer errors in the memory series. The average time for the other two birds is not quite equal to the last ten trials of the initial series but is better than the second ten of this series. The Cowbird seems to have forgotten little or nothing, the other two forgetting more of what they had learned a month previous but by no means enough to place them in their earlier inexperienced condition. Here again the differences between the individual birds are so slight, especially between the Vesper Sparrow and the English Sparrow, that it is well not to make too much of them.

Immediately following these memory tests the maze was reversed thus compelling the birds to enter from the opposite

TABLE III.

Tests with Maze Reversed.

No. of Trials.	VESPER SPARROW.		COWBIRD.		ENGLISH SPARROW. Female. 5.	
	Time.	Errors.	Time.	Errors.	Time.	Errors.
1	554	33	135	27	780	24
2	33	1	15	4	120	5
3	31	2	11	1	41	2
4	35	4	38	5	106	5
5	36	3	10	2	62	2
6					23	1

corner. In this table the individual results for each trial are given. I have not averaged each two successive trials. It can

easily be seen from the accompanying table that the effect of this was to upset entirely the habits previously formed. The beginning times and errors are very high. At a certain turn in the maze they tried very hard to go in the old direction. This was rapidly overcome as the succeeding trials clearly show. The behavior of the birds in this experiment tends to strengthen the opinion formed from earlier experiments with the more complex maze; namely, that, especially after the maze is learned, the birds do not depend on sight alone for their cues as to when to turn and in which direction, but on a sense of direction and distance as well. That this is, at least in part, in terms of muscular sensations is probable.

TEST WITH FOOD-BOX WITH PIGEONS AND COWBIRD.

The box used was not identical with the one used in the earlier study with the English Sparrows alone. It was thought advisable to make it considerably larger, especially for the

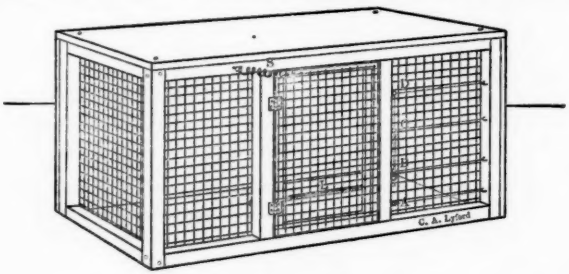


FIG. 2.

pigeons. This box is twenty inches long, thirteen inches wide, and twelve inches high. The latch L is on the inside and when let down the door closes by means of a small catch which is fastened to the door. This latch may be easily raised by pushing or pulling any one of the strings A, B, C, or D. A spring at S pulls the door open when the latch is raised. The end to the left and the entire front are of wire mesh, so that the food is easily visible from most points in the large cage. The top and the other side and end are solid. When experimenting the right end was placed against the wall of the large cage. As in the earlier tests, the birds were fed in this box with the door open for at least two days before the experiments proper were begun. During most of the time this box was removed after the bird had eaten. This gave the birds the freedom of the large cage during the interval between tests, a very desirable condition to fulfill if it is at all possible. In taking the time the watch was not started until the birds

reached the floor near the box or were standing on the box itself. As in all other tests previously described, a record was kept of the number and kind of errors made. These, however, do not appear in the table. The tests were made several times daily, varying from two to nine in number. This number was practically the same for the different birds. In the table below, which is to be interpreted in the same manner as Table I, will be found the results obtained with the Cowbird, a male Pigeon and a female Pigeon. The female Pigeon was some five or six years old and of the Passenger variety. The male was younger but apparently had attained his full size and growth. He was of the common Dove-cot variety. I could do nothing more than merely begin a series with the young English Sparrow, No. 5, her fright by this time had caused her to become so unmanageable. The other English Sparrow, No. 8, died before I could try her by herself, and still another one fell a prey to gray rats.

As is probably the case with all tables, the notes describing the actual behavior of the animal are quite necessary for the correct understanding of the results. This is especially true in the present case. The description of the conditions and the results for the Cowbird will be given first. Her first method of opening the door was by hopping up on the side and pushing in the strings with her claws. This was done entirely at random during the first and following trials. She was somewhat frightened and consumed much time in standing before the strings in a half crouched attitude ready to act. To make it easier for her, as well as to see what they each would do, the Vesper Sparrow and an English Sparrow were turned into the cage at the same time. But the Vesper Sparrow was soon removed because she showed little disposition to get into the box, and also because of the vociferous attention which she paid to the others. I was not able to satisfy myself as to whether this was a manifestation of hunger or sexual excitement. It was probably the latter. She later fluttered against the side of the cage and showed a strong desire to escape. She soon died. It was in early spring and her actions were probably those of the mating period. With very few exceptions the English Sparrow was leader. She often made several excursions to the box before the Cowbird reached it. Some few times I have thought the Sparrow was imitating in some slight way the other's method of opening the door, but I could not be sure of this. The Cowbird gradually reduced the number of useless efforts at other places on the box and at the same time learned to use the bill instead of the claws. She also dispensed with the hopping up on the side of the box and remained standing on the floor while opening the door. This is

TABLE IV.

Experiments with Food-box.

No. of Experiments.	COWBIRD.	PIGEON, Male.	PIGEON, Female.
	Time.	Time.	Time.
1–2	140	345	397–F
3–4	570–F	F–670	248
5–6	F–125	F–240	101
7–8	220	810–F	72
9–10	630	F–550	25
11–12	117	687	75
13–14	64	217	34
15–16	31	882	38
17–18	95	97	26
19–20	45	130	57
21–22	71	470	34
23–24	75	117	18
25–26	40	240–F	18
27–28	45	277	66
29–30	79.	210	25
31–32	116	702	38–F
33–34	52	112	32
35–36	81	320	19
37–38	24	51	23
39–40	47	112	23
41–42	39	65	
43–44	21	118	
45–46	21	205	
47–48	16	F–100	
49–50	7	377	
51–52	10	F–192	
53–54	3	76	
55–56	20	76	
57–58	7	246	
59–60	40	58	
61–62	4	138	
63–64	3	201	
65–66	3	98	
67–68	7	176	
69–70		72	
71–72		198	
73–74		217	
75–76		140–F	
77–78		62	

a very similar procedure to that used by the Sparrow No. 4 of the earlier study. Although the two boxes were not alike the method of opening was quite the same. The Sparrow used the bill at the tenth trial and stood on the floor at the twenty-seventh. The Cowbird used her bill on the forty-sixth trial and opened the door from floor at the fiftieth, though she does not consistently use this method until eleven tests later. As compared with the English Sparrow she seems rather slower

in leaving off the unessential and in learning just the thing to be done. However, it is a point worthy of note that both proceed in the same manner to reduce the necessary action to its lowest terms.

The male Pigeon opened the door first and last in the same way—striking one of the strings with his bill. There was thus no opportunity for him to simplify his action. He stood on top of the box or on the floor near the box a great deal of the time. Seeing parts of the box or the food seemed to suggest with difficulty the required actions. He early established the habit of going for a drink and sometimes opened the door on his return. His manner seemed to indicate considerable indecision, even after he had approached the box a number of times. In the fourteenth trial he struck the string three times after the door had swung open. The same thing occurred twice in the following trial, once in the twenty-fourth and the twenty-sixth, twice in the twenty-seventh, once in the twenty-eighth, and four times in the sixty-eighth. Three of the latter were rather vicious hard pulls on the string, and after starting to enter he turned and pulled the string the fourth time. Often after stopping in front of the strings he made several feints at striking them before really doing so. He seemed to see very keenly. The slightest shadow on the cloth side of the cage was enough to disturb him. He was very easily distracted, reminding one not a little of a nine months' old child, who apparently starts across the room for some object but forgets about it before it has scarcely started.

The female pigeon opened the door by simply walking up the side over the strings until some one of them was pushed in. In the fourth trial she used the bill on the top string. During the succeeding trials she used several methods—pushing in with her breast. and pulling the lower string with her bill or claw while standing on the floor. Not until the thirty-first trial did she use one method exclusively. This consisted in pulling down on the lower string with one foot. As with the male Pigeon, many trials show several approaches to the strings before the door is opened.

An attempt was made with the female English Sparrow whose wildness had caused me to discontinue the series with the reversed maze. She was so wild that but eight trials were made, she being successful only on the second and fourth trials. However, in the fifth and succeeding trials it was clear that she tried repeatedly to seize the strings with her claws without alighting or even touching the box. But before quite reaching them she hovered and flew away. It was probable, judging from my experience with others of her kind, that she had already selected in spite of her fear, or it may be because of it,

the essential part of the apparatus. I say because of fear, for it may very well be that a reasonable amount of fear and caution may act as a stimulus to a more rapid singling out of just the required things to do, and the parts to be worked upon.

While making the tests, the results of which are recorded in an earlier paper, a Red-headed Woodpecker came in through the open window and was caught. A short series of experiments was made with the food-box, figured (9, p. 319); also several unsuccessful attempts were made to get him through the same maze as that used with the English Sparrows. He showed very little caution in his first approach to strange objects placed in the cage. The food-box he opened very readily the first time. He did this by pecking the latch; and as we all know this is, *par excellence*, his one natural method of getting his food. But succeeding trials showed lack of ability to profit by experience. This in spite of the fact that apple and other food more to his liking than that used for the English Sparrows was placed on the inside. Yet most amusing and instructive of all was the way he pounded the bottom, but chiefly the wire mesh, of the maze with his bill. It is true that the maze was a little small for him, particularly when he attempted to turn round; but instead of trying to walk through he spent the greater part of his time in pecking at the sides and bottom of the maze. Frequently he thrust his long tongue, peculiar to his kind, through the wire mesh. These results, though few and negative for the most part, serve to re-emphasize the place which very often the natural instinctive activity of the animal should be given in our efforts to study its intelligence.

These results also served to suggest for solution a question concerning the learning act in the individual animal. As indicated above, this Woodpecker opened the door very easily on the first trial; so also did the Vesper Sparrow the first times through the maze, and the male pigeon in opening the food-box. Now the query arises whether greater difficulty and therefore more vigorous activity on the part of the animal in the initial trials of any series may naturally be expected to lead to more rapid progress in the later ones. The greater activity would give through the back-stroke impulses a richer experience. All the movements except the one bringing the right result may be looked upon as having a slightly disagreeable affective tone; at least, the movement opening the door or bringing the correct adjustment of the organism is affectively colored in an agreeable way. The trouble which the Cowbird had with the Simple Maze, and the fear and caution which she had in consequence of this, may have made her react in this particular experiment in a way similar to the habitual way of the English Sparrow. With the food-box, designs, colors, and

forms she was much more at ease. These facts are far from conclusive and all that is attempted is again to call attention to a very desirable further analysis of the learning act, especially as it is modified by those mental states which are more predominantly affective and motor.

There is some ground in what has just been said for thinking that the first half of the proverb, "No man learneth but by pain and shame," may very well be true of animal learning as well. To be sure, the difficulty, activity, or emotional condition must not be too extreme. "Soon learnt, soon forgotten," and "One learns by falling (failing)" may be found to be even more applicable. The above suggestions gain added weight from the fact that Professors Jennings ('04 and '05) and Pillsbury ('06) have recently so extended the trial and error method as to make it constitute, according to the former, the essential principle of regulation, chiefly of behavior, in the inorganic as well as the organic, according to the latter, as the essential factor in evolution, even including the social life of man. As further proof that this same method may be found to apply to the instinctive activity of higher invertebrates, the reader is referred to the abstract of the writer's work with Spiders (10, pp. 44, 45). The original paper will appear in the next number of this *Journal*.

The preceding may be of some help in interpreting the failures recorded in the above table, particularly those against the male Pigeon. Some of these fall late in the series. Such is not the case for the Cowbird except during the first few tests, and the female Pigeon failed but once after she was well along in the series. The time measure for the male Pigeon is irregular and very slowly drops toward the minimum, indicating that learning is rather a slow and uncertain process with him. The Cowbird is considerably better, but not quite so rapid and well sustained as the female Pigeon; while if we compare the time for the English Sparrows it will be seen that in general they are very similar. While the times for the English Sparrows show a better ability to learn than even the female Pigeon and the Cowbird, yet the variations are not so great but that they may be cancelled by individual differences. It is quite obvious that the cases tried are too few to permit of any elimination of these differences.

Memory Tests.

After an interval of thirty days these same three birds were tried again with the same box. As before, with the simple maze, there were no intervening tests. In general the same differences obtain in these memory tests as in the initial series. There is not much difference between the Cowbird and the

TABLE V.

Memory Tests with Food-box. Thirty Days Interval.

No. of Trial.	COWBIRD.	PIGEON, Female.	PIGEON, Male.
	Time.	Time.	Time.
1–2	65	102	36
3–4	12	320	27
5–6	36	20	14
7–8	46	29	15
9–10	8	38	19
11–12	12	23	87
13–14	12	19	40
15–16	39	30	32

female Pigeon. The male Pigeon is not long in returning to his former record. It should be added, however, that I had learned by this time to take extra precautions to be sure that the male Pigeon was really hungry. There were some indications that the over-night interval did not make him as hungry as the other birds, especially the English Sparrows. If there is really a difference of this kind here, it is very important, and should be taken account of in later experiments.

Both the Cowbird and the female Pigeon lapsed to their earlier way of opening the box after this interval of thirty days. It will be recalled by those who read the results of my first study that a change in the fastening caused the English Sparrow to revert to his old habit. But it is interesting to note that his following of the old habit is of short duration, lasting only during the first few trials. The male Pigeon's method, as pointed out above, was as simple from the first as it could be. But in this memory test he must approach the box as many as four times before acting. In the following trials there is less of this.

One hundred and twenty days later for the Cowbird and one hundred and forty days for the male Pigeon a second memory series was obtained. It is evident from Table VI that there is greater loss through this longer lapse of time and the same difference between the two birds is more marked than in the other memory series.

After the thirteenth test in this series with the Pigeon, the strings which opened the door were placed to the left of the door, the original strings being left on the right, but which it now did no good to pull. The food was taken from immediately back of the old strings and placed in the same position with reference to the new ones. This change caused him some trouble. Most of the times are long and he shows a much less rapid reduction of useless efforts than the female Sparrow (9, pp. 22 and 23), with which a very similar test was made. He

TABLE VI.

Memory Tests with Food-box. Second Series. Intervals 120 Days for Cowbird and 140 for Pigeon.

No. of Trials.	COWBIRD.	PIGEON, Male.
	Time.	Time.
1–2	132	1800–F
3–4	37	355
5–6	54	24
7–8	34	80
9–10	15	132
11–12		33
–13		55

is also slower and more irregular in reducing the time to a minimum.

TESTS WITH DESIGNS.

These were made only with the Cowbird. The test was an exact repetition of the one made earlier with the female English Sparrow. Glasses covered with gray paper were surmounted by cards carrying designs. The food was first placed in the glass carrying the card with three horizontal black bars, and alongside of this was placed a similar glass carrying a blank card. Next the food was placed in the glass with the card carrying a black diamond, and used as before along with the glass carrying a blank card. In the third series the horizontal bars and the diamond were used, the food being in the glass bearing the diamond-marked card.

The place of the food-glass was irregularly shifted from right to left and *vice versa* while the bird was behind me. Twenty tests were made at each sitting. If the bird came to the wrong glass she was allowed to feed a little out of the right one. The table below gives the correct number of choices out of twenty trials for both the Cowbird and the English Sparrow, the results for the latter being taken from my earlier work (9, p. 345).

FOOD IN GLASS WITH HORIZONTAL LINES.

Cowbird,	11	16	17	19	19	19	18	18	19	19	19
English Sparrow,	14	13	15	14	15	16	16	20	20	18	17	20

FOOD IN DIAMOND-MARKED GLASS.

Cowbird,	16	17	14	17	19	20
English Sparrow,	18	14	12	18	18	20

FOOD IN DIAMOND-MARKED GLASS TO BE DISTINGUISHED FROM ONE WITH HORIZONTAL LINES.

Cowbird,	1	4	6	7	10	12	12	16	17	19
English Sparrow,	11	14	12	18	18	20				

It should be noted that the Sparrow made alternate choices from opposite ends of the cage while the Cowbird flew always from the same perch. The Sparrow usually alighted directly on the edge of the glass of her choice but the Cowbird always flew to the floor and then walked slowly to the glass of her choice. Her vacillation or indecision was very noticeable at times. The first and second series show little if any difference in the rate of learning or ability to discriminate. However in the last series where somewhat nicer discrimination is called for and an old habit must be inhibited the Cowbird seems much the slower. Some may ask if it is not possible to find designs that are not so foreign to the animal's experience. My answer would be that such may be quite possible. The reason for using these was the fact that Dr. Kinnaman used them with his monkeys and obtained negative results with them. By using the same apparatus and methods of experimentation as nearly as may be is the only way to obtain results which will admit of close and exact comparison. Both the Sparrow and the Cowbird learn to discriminate these designs from no design and from each other and it was that the comparison might be made as exact as possible that these designs were used.

Color Discrimination.

Six glasses were covered with the Bradley colored papers, a dark gray, a light gray, a bright yellow, a dark blue, a light green, and a dark red. Samples of the papers used with the Sparrow were used to match from. These glasses were placed in holes in a board. The same programme which determined the place of the glass for the Sparrow was used here. Here also twenty tests were made in each successive series. The following table gives the number of correct choices for each series with the results for the Sparrow again brought forward for comparison.

	Food in Blue.
Cowbird,	5 9 11 12 12
English Sparrow,	12 14 13 12 19
	Food in Yellow.
Cowbird,	4 4 9 11 10 11 15 18 17 18
English Sparrow,	0 5 1 5 8 16 11 13 18 19
	Food in Red.
Cowbird,	8 6 14 16 17 20
English Sparrow,	2 1 9 15 14 20
	Food in Green.
Cowbird,	6 10 16 18 17
English Sparrow,	9 17 15 14 18

Both birds learn to discriminate between the different colors at almost an equal rate. The first color used, the blue, showing the widest difference in favor of the Sparrow. Again, it should be added the latter's approach was much more direct and her choice seemed more decisive. The closest attention on my part was necessary to see that the Cowbird did not peek into the glass next to the food glass before committing herself to a final choice. She did not manifest the color preferences which the Sparrow was found to have. The latter was at first disposed to avoid red, yellow and green.

The few tests which I was able to make with the forms indicate that the Cowbird was learning to distinguish the triangular from all the others. This the Sparrow could or did not do. Yet there was one important difference which crept into my way of trying the experiment with the Cowbird. The box containing the food was shifted each time, it is true, but the triangular box always presented the same face to her. With the Sparrow there was a constant shifting of faces, and it is possible that this makes it too difficult. Yet it will be most interesting to determine if the Cowbird in her detection of other nests, and within limits of those best for the preservation of her species, gets any help, instinctive or otherwise, in the correct distinguishing of these forms. Some tests with the same male monkey which Dr. Kinnaman experimented upon, indicate that he has considerably greater difficulty in distinguishing these forms than those which Dr. Kinnaman used. The latter, it should be stated, were not so free from differences in size.

Affective and Volitional States.

Since this work was begun attention has been given to the emotional and volitional reactions of the birds dealt with. When confined in the small cages the English Sparrows were most frightened by my near approach. They were as cautious as the Cowbird, perhaps more so, while the Pigeons and the Vesper Sparrow showed little of caution. The former sustained their reputation for timidity while the latter seemed so fresh from wild nature itself that it could not be otherwise than trustful. The female English Sparrow, as we have seen, was too fearful to open the food-box in a reasonable length of time; yet when the door to this box was open, and the male Pigeon inside, the same Sparrow entered and re-entered, although the Pigeon had already driven her out.

When conditions were reversed the Pigeon sometimes failed to enter when the Sparrow held possession. This characteristic boldness of the English Sparrow is seen in the way it frequently despoils the Robin of the worm the latter has just found. At most any time in late summer on the University

lawn one may see a Sparrow alight some six or eight feet away, wait until the Robin has found a tempting morsel, then rush in and relieve him of it. Even the Cowbird, perhaps, accomplishes the laying of her egg in some other bird's nest rather through stealth than by driving the rightful owner from the nest. It seems to me that this stealthy manner was evident many times during the experiments with her. When confined in small cages with English Sparrows she was able to lord it over only the sick ones. She seemed to keep her weather eye open, and especially just after alighting would turn her head half way over so that she might take in the whole expanse of the sky. Rouse (11, pp. 512 and 513) in his study of Respiration and Emotion in Pigeons, finds that the breathing previous to habituation is profoundly influenced by sounds, mechanical jars, and, perhaps, odor, jars particularly causing abrupt inhibitions and irregularities. Stimulation by light caused much less disturbance than mechanical stimuli. It is probable that *agreeable feelings* are accompanied by respiratory quickening (and perhaps by shallowing and irregularity). After hearing a report of the present paper (10, p. 45), Mr. Rouse tells me that his later results on the intelligence of the Pigeon point to the same general differences in favor of the English Sparrow.

The English Sparrow is more active than any of the other birds. This with his boldness and caution makes him appear, at least, to have a goodly amount of curiosity. This, according to many writers on Psychology, is the best possible basis for a rapid development of the learning process. I refer here especially to lectures by Prof. Wm. H. Burnham, of Clark University, on such instincts as those of Workmanship, the Instinct for Further Cognition, etc.

Kinnaman (5, pp. 195 and 196) says of the individual differences between his two monkeys: "In their reaction to the locks, the male moved more rapidly about the boxes. He tried more persistently and gave up only after many fruitless efforts. . . . She always seemed stupid in the beginning, but often came suddenly to the idea, and finally, if it was an easy thing, learned it more quickly than he. . . . In all of the very difficult things he appeared to be superior, but for the easy things she was superior. If we turn to the association with forms the reactions were very much alike. . . . The female learned the colors more readily than the male." The author suggests that the male was too rapid and nervous for the best results in these last two tests; so also for the lower numbers of the number tests, but he continued the associations up to six, while she stopped at three.

Watson (14, p. 47) has very well emphasized the necessity

of keeping the kind of test well in mind if we would distinguish between mental accomplishments of animals. He says: "Considering first a problem where mere activity is at a premium for its solution, we find that the adult rat consumes more time for a first solution than does a young rat, but that for a second solution this difference in favor of the immature rat is not so marked. . . . Considering next a problem not so conditioned upon activity—such as the test with Box II—we find that not only does the adult rat show a smaller record for the second success, but that even the time for the *first* success is *much* less than is the time for the first success of any group of the young rats." There are many more useless movements made by the young rats. Small (13, p. 159) also makes superior vitality and activity explain the advantageous showing which his young rats made. The general impression which one gets from seeing my birds go through the tests (my attempts to actually measure the amount of their daily activity not having progressed far enough yet to allow of any definite results) is that the English Sparrow is most active of any, the pigeons being least so.

The Cowbird imitates the Sparrow in following her to the food-box. In turn it was thought that the Sparrow showed some signs of reacting in the same manner as the Cowbird toward the fastenings of the food-box. About the first of August, in Illinois, I have seen large flocks of these Cowbirds, many of which were apparently young ones. At this season they seem to feel that they belong together as the young of English Sparrows do. The young of both no doubt are better able to survive by association with the old and each other.

All the birds are able to confine their attention to a particular part of the box. This implies control of an inhibitory as well as a positive kind. Roughly speaking, the Pigeon and Vesper Sparrow showed least of this. They were not tried with the same apparatus, so that the above statement means so far as their respective tests are concerned and as contrasted with the other birds, Cowbird and English Sparrow. The Sparrow is no better in many of the tests, so far as this control is concerned, than the Cowbird. In the breaking up of an old habit where it antagonizes the new, and in the early reduction of a habit to its lowest terms, the English Sparrow is perhaps a little better than any of the others. The writer hopes that the present paper may approach more nearly to the standard recently set forth by Prof. Mills (7, p. 751), namely, that animals be tested in such manner as will bring out their powers of inhibition and control.

However true the above differences may be, or may be found to be on further experimentation, the writer does not hold that

the facts set forth in the present paper are at all sufficient in number to permit of any safe generalizations as to the superiority, in a mental way, of any one species of bird over another.

A summary of the results obtained and conclusions arrived at may be stated as follows:

1. The Vesper Sparrow, Cowbird, and four English Sparrows, learn the simple maze, a plan of which is shown on page 253. They all have it pretty well learned by the 15th-20th trial. After qualifying conditions are allowed for, there is perhaps little superiority of the English Sparrows over the Cowbird. The Vesper Sparrow seems to be the slowest in learning, a fact which is further strengthened by her changing fifteen times out of thirty from the long to the short way.

2. The memory tests with this same maze thirty days later show a surprising memory on the part of these birds. The Cowbird is best here. Her average for ten trials quite equalling that of the last ten of the initial series. The Vesper Sparrow and the female English Sparrow do not do quite so well. The latter was too young and too easily frightened to be a good subject.

3. The results with the food-box, see Fig. 2, page 257, which was used with the Cowbird and a male and female pigeon, give evidence of ability to rapidly profit by experience on the part of these birds. There are more failures later in the series by the Pigeon, especially for the male, than for the Cowbird. If we compare these birds with the English Sparrow, the latter were tried with a different box but it was not an essentially different fastening, there would seem to be a more rapid and consistent reduction by the English Sparrows of the time and efforts put forth. If we include the further simplification of the act of opening the door and its saving in effort, the English Sparrow is perhaps superior.

4. Memory tests after thirty days with these same three birds and the same box, no other tests being made in the meantime, show, in addition to the experiments on memory described above, that the Pigeons as well have a fairly good memory. This lapse of time has the interesting result of causing a reversion to a habit older than the one used when the former series ended. An interval of one hundred and twenty days for the Cowbird and one hundred and forty for the male Pigeon showed that much more was forgotten than during the former shorter interval.

5. The Cowbird learns to distinguish between the different designs—the three horizontal black lines on one card to be distinguished from a blank card, a card marked with a black diamond, from a blank card, and the two marked cards. There is not much difference here between the Cowbird and the English

Sparrow. The latter unlearns the old habit and therefore learns the new one earlier in the third series which, of course, is the most difficult.

6. In learning to distinguish between the colors the female English Sparrow does better with the first color tried—blue. After that the difference is not so great.

7. The tests with forms had to be left unfinished; but the Cowbird showed that she was learning to distinguish the triangle. The sparrow gave no evidence of this. Whether or not this is a real difference between the birds or is due to a different method of trying the experiments, must be left for further investigation to decide. Experiments with Jack, the same male monkey which Dr. Kinnaman experimented with, and my form boxes show that he has considerably more difficulty with these from which differences in size have been eliminated, than with those of Dr. Kinnaman.

8. The English Sparrow when confined in the same cage with the other birds has shown itself more capable of fear, courage or boldness, caution, and independent action. It was more of a leader, more persistent and more active. The Cowbird was almost as wary as the Sparrow yet at other times she was not so bold. The Pigeon's popular reputation for timidity and keen sense of vision was well borne out by my observations and experiments. The value to the animal of these differences, some of them marked, in emotional and volitional states is apt to be overlooked or, if noted, underestimated.

9. All, of course, show a distraction of attention as is quite to be expected from wild birds experimented on in captivity. This distraction or inability to keep the attention on one thing was (barring the wildness of the young female English Sparrow) most noticeable in the Pigeons, Vesper Sparrow, and Cowbird, and least in English Sparrows.

It is a pleasure to me to again acknowledge helpful suggestions from Professor E. C. Sanford; also to Mr. Toshi-yasu Kuma for making for me most of the Form tests on Jack, the monkey, and to Mr. Burton N. Gates, a fellow student, for the female pigeon used in some of my experiments.

Bibliography.

1. Chapman, F. M. Bird Life. D. Appleton & Co., New York, 1901. pp. 195+88.
2. Coues, Elliott. Key to North American Birds. Estes & Lauriat, Boston, 1887. pp. 895.
3. Jennings, H. S. Contributions to the Study of the Behavior of Lower Organisms. Carnegie Institution of Washington, D. C., 1904.
4. —— ——. Modifiability in Behavior. I. Behavior in Sea Anemones. Method of Regulation in Behavior and in Other Fields. Jour. Exp't. Zoöl., Vol. 2., pp. 447-472; 473-494.

5. KINNAMAN, A. J. Mental Life of Two Macacus Rhesus Monkeys in Captivity. *Amer. Jour. of Psy.*, Jan. and April, 1902, Vol. 13, pp. 98-148; 173-218.
6. MILLS, J. WESLEY. Animal Intelligence. The MacMillan Co., New York, 1898. pp. 307.
7. —— ——. Some Aspects of the Development of Comparative Psychology. Science, 1904, Vol. 19, pp. 745-757.
8. PILLSBURY, W. B. Trial and Error as a Factor in Evolution. Pop. Sci. Mo., 1906, Vol. 68, pp. 276-282.
9. PORTER, J. P. A Preliminary Study of the Psychology of the English Sparrow. *Amer. Jour. Psy.*, July, 1904, Vol. 15, pp. 313-346.
10. —— ——. Proc. Am. Psy. Assn., Psy. Bull., 1906, Vol. 3, No. 2, pp. 43-45.
11. ROUSE, J. E. Respiration and Emotion in Pigeons. Jour. Comp. Neurol. and Psy., 1905, Vol. 15, pp. 494-513.
12. SCHMEIL, O. Text-book of Zoölogy. A. and C. Black, London, 1901. pp. 493.
13. SMALL, W. S. An Experimental Study of the Mental Processes of the Rat. *Amer. Jour. Psy.*, Jan., 1900, Vol. 11, pp. 133-165.
14. WATSON, J. B. Animal Education. The University of Chicago Press, 1903. pp. 122, 3 pl.
15. WHITMAN, C. O. Animal Behavior. Wood's Hole Biological Lectures. Ginn & Co., Boston, 1898.

HYPNAGOGIC IMAGES AND BI-VISION IN EARLY CHILDHOOD. A NOTE.

By Alexander F. and Isabel C. Chamberlain.

The subject of this note is the daughter of the authors, aged, at the time of the observation, 4 years and 4 months. On November 25, 1905, she said to her mother:

"Mama, do you see pictures, when you shut your eyes when it's dark?"

Her mother replied, "Yes, sometimes. Do you?"

Whereupon the conversation continued:

R. Yes, I see all kinds of funny men and animals.

M What else do you see?

R. Sometimes, when I shut my eyes, I seem to go right down through the floor.

M. What do you do down there?

R. O, I see all sorts of funny things.

This conversation took place in the day-time. The next night, after she had been in bed a few minutes, Ruth called her mother, and said:

"Mama, when I shut my eyes and go down through the floor (just make-believe, you know, not really), why, sometimes I go into water. It 's just make-believe water, is n't it? There is n't water really under the floor, is there?"

To this her mother replied: "Oh, no, that is just a kind of dream where you see the funny things and have funny things happen to you."

And Ruth continued: "Yes, I suppose, it must be dream-land where you go when you shut your eyes."

On December 4, 1905, her father asked her some questions concerning these "pictures." In her answers she said that she "saw it all crowded up with funny people and things," and that "they keep changing to something alike."

This discovery of "hypnagogic images" by so young a child is, perhaps, worth placing on record here. The thing had never been discussed or ever mentioned by her parents or by any one of her environment or acquaintance, and her announcement of seeing pictures with her eyes shut was entirely spontaneous and not led up to or suggested by word or action of other persons. The "going down through the floor," the "water," the "crowding up," and the "keep changing to

something alike," are interesting items in the description of the phenomena in question.

Another observation, relating to bi-vision, may also be recorded here. On November 14, 1905, Ruth said to her father, "When I look at my nose, I see two tathers (fathers)."

It would seem as if some of the psychological and physiological phenomena now on record only for a much older period of life, not only occur in early childhood, but are perceived by children and may possibly exert some influence upon the development of the individual.

THE ELECTRICAL SUPPLY IN THE NEW PSYCHOLOGICAL LABORATORY AT THE LELAND STANFORD, JR., UNIVERSITY.[1]

By LILLIEN J. MARTIN.

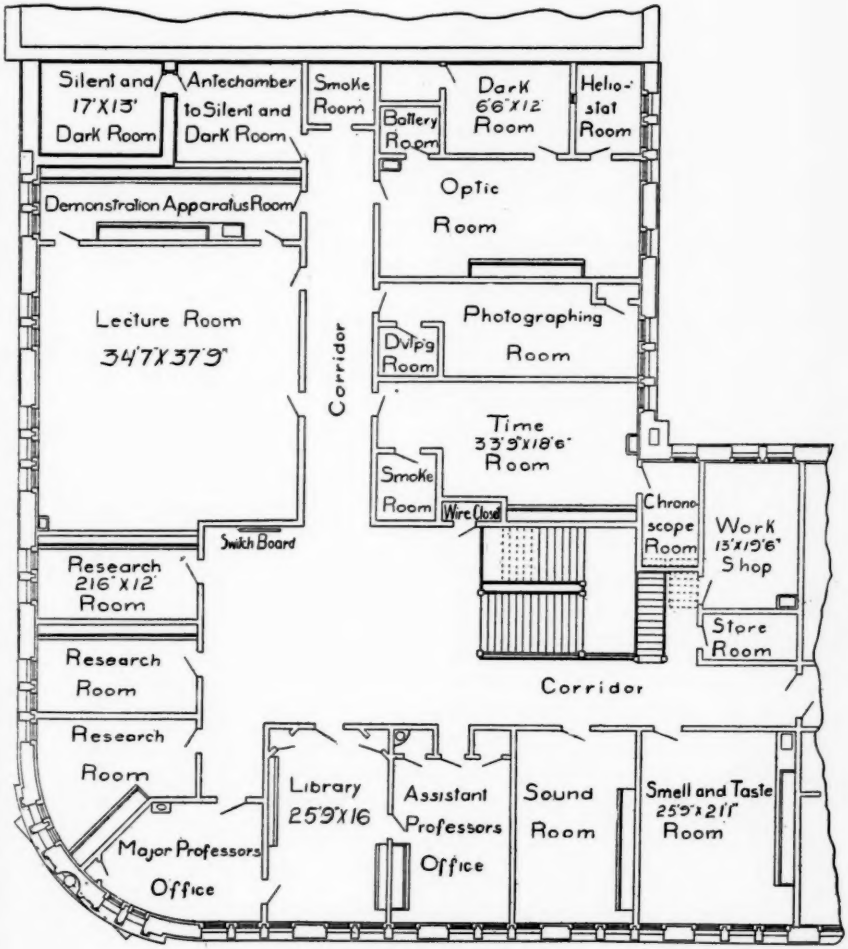
The Electrical Supply. During the construction of the laboratory it was wired for three different electric currents:

1. *The alternating current,* which is supplied to each room and closet for illuminating purposes, for making experiments with light, and for use with motors constructed for this particular current. (1) This current might also be employed with small direct current motors, but the abundant supply of more suitable currents makes its use for this purpose unnecessary in this laboratory. (2) Aside from the four clusters of bulbs for illuminating purposes, the lecture room is supplied with this current at five other points, making it possible conveniently to shift the stereoptical and other optical instruments to the place desired. The alternating current, through the use of a transformer, runs an induction motor which drives two direct current generators, and these furnish the direct current.

2. *The direct current.* The generators for producing this current are placed in the basement of the building and also supply electric power to the Physics Laboratory. The switches, etc., used in setting this machinery in motion are so easily manipulated that even an inexperienced person, as regards the handling of such machinery, is easily taught how to turn on and shut off the current as may be desired. There is one current with two outlets of 55 volts each supplied to each room of the psychological laboratory. In the lecture room there are four such currents placed in different parts of the room. Each current is admitted and shut off by a Lang switch

[1] PLAN OF THE PSYCHOLOGICAL LABORATORY.

Special rooms have been set apart for time, optical, sound and smell experiments only. The apparatus for other classes of experiments is placed in the cases in the research rooms and can be used in those or other rooms. Much of the apparatus used by the beginners in laboratory work has been duplicated and is stored in cases in the hall. All of the apparatus used for a given experiment is set out on a large table, which has been placed there for the purpose, and from this it is distributed. According to the original plan the smoke rooms, used for smoking drums, were to have been provided with flues for carrying away the superfluous smoke, but as yet these have not been put in.



PLAN OF LABORATORY.

which for purposes of protection is supplied with a fuse. The switch is mounted on a square board (see Fig. 2, B) on which the positive and negative poles are marked, and this is placed at the side of the room storage battery switchboard. When a suitable form as regards range of measurement and size of apparatus can be found, a rheostat for controlling the strength of the current is to be permanently mounted on each of these boards. At present the current is roughly controlled by a set of Scripture lamp-batteries with darkened bulbs, and more finely by connecting through plugs attached to the board one of the Rosenbach's rheostats made by Spindler and Hoyer of Göttingen (see Fig. 2, C). This current is for use when a current above 12 volts is required. It also supplies the current with which the storage batteries are charged.

3. *Storage and other battery currents.* Expense, awkwardness of manipulation, inconstancy and irregularity make the two previous currents unsatisfactory for much experimental work in the psychological laboratory. The laboratory has, therefore, been supplied with various forms of battery currents, as those generated by the storage batteries made by the Electric Storage Battery Co., by gravity batteries, by the Edison-Lalande batteries, by dry batteries, etc. The batteries are placed in the battery room, and through connection with wires running from this room to the general switchboard (see Fig. 1) the current or currents desired can be obtained in each of the rooms.

The general switchboard (made by the Drendell Switchboard Co., of San Francisco) also makes it possible to connect two or more rooms in circuit. For the ordinary purposes of the laboratory the storage battery is employed and the switchboard has been especially constructed with a view to its use, though any of the other batteries can be substituted for it should it be desired. The general switchboard is enclosed in a case having glass doors and is fixed to the wall in the hall, but for convenience of repair it has been so constructed that it can be reached from behind through doors in the wall in the lecture-room. The board is supplied with three storage battery currents, 1, 2, 3, having a voltage of 2, 6 and 12 volts respectively. The amperage of 1 and 2 batteries is 10 and of 3, 8 amperes. Current 1 is supplied by one element of the "Chloride Accumulators," manufactured by the Electric Storage Battery Co., of the type "E" with 5 plates, 7¾ in. x 7¾ in.; current 2 by connecting in series three of the same elements; and current 3 by similarly connecting 6 of the elements of the type "D" with 7 plates 6 in. x 6 in. By turning the arms of the switches V and A which connect the voltmeter a and ammeters b, b, b, with the various batteries on 1, 2 or 3, it is possible to determine the strength of the charge of that particular battery at

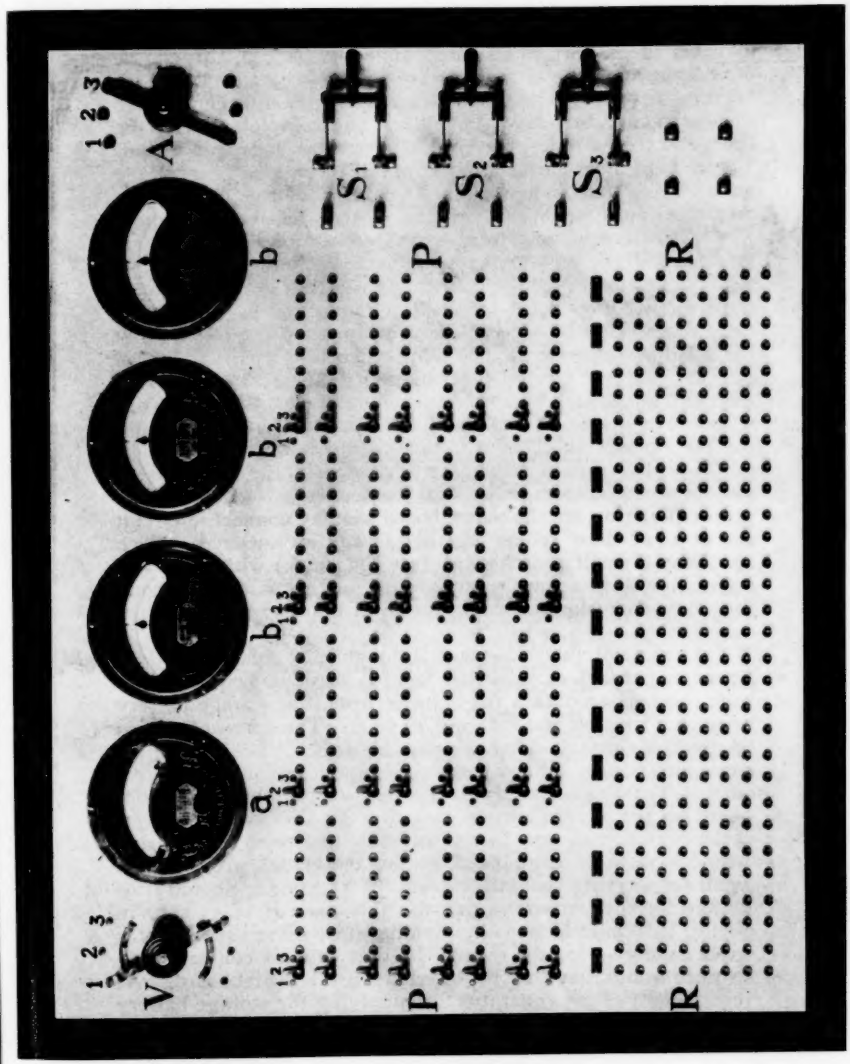


FIG. 1. LARGE SWITCHBOARD.

the moment, and should any battery need restoring to its normal strength, in order to avoid the injury that comes from allowing the battery to stand incompletely charged, this can be done by turning the arm of the switch A, on 1, 2 or 3, and reversing the switch S_1, S_2, S_3 which supplies the direct current to that particular battery. As regards the completeness of the charge in the batteries, the voltmeter acts as a danger signal. The current must not be allowed to fall below a certain voltage before being restored. In the renewing of the charge the ammeters show when the required charge has been reached. The voltmeter and ammeters on the switchboard give, of course, only the voltage and amperage of the current at the board. A portable voltmeter and ammeter is used for getting the current strength after it has reached the rooms and for finding the resistance offered by a given piece of apparatus. The arms of the small switches on the board in connection with one set of plug holes PP bring the particular currents desired to these different holes, and by connecting these holes through plugs with one or more of the pairs of holes RR of the sets of eight pairs of holes which belong to each room, it is possible to obtain eight currents in each room having a voltage of 2, 6 or 12 volts and an amperage of 8 or 10 amperes. Moreover, by proper plugging on the same board we may connect in circuit any or all of these rooms together in any way desired. Each room has a small switchboard (see Fig. 2, A) with holes corresponding to those on the large board for this particular room, so that no confusion regarding the particular current connected may arise.

The room switchboards make it possible, by connecting their terminals parallel or in series, and by introducing the Rosenbach rheostat, to obtain any voltage from the storage battery between a fraction of a volt and 20 volts. The current can also be reversed through using the switchboards. Should it be desirable to connect different rooms in circuit in using the direct current, the direct may be substituted on the general switchboard for the storage battery current. In that case, however, if the current was sent by but one wire to a room a resistance would have to be introduced, as the individual wires are too small for carrying the full current of 55 volts. Should it be desired for any purpose to put the full current of 55 volts in circuit, this could be done by dividing it by using the 8 pairs of wires belonging to each room. In that case, of course, no resistance would have to be inserted at the switchboard. As regards cost of the apparatus for supplying the storage battery current to the laboratory, it may be said that the switchboards and batteries and the putting of them in position cost approximately $1,500.

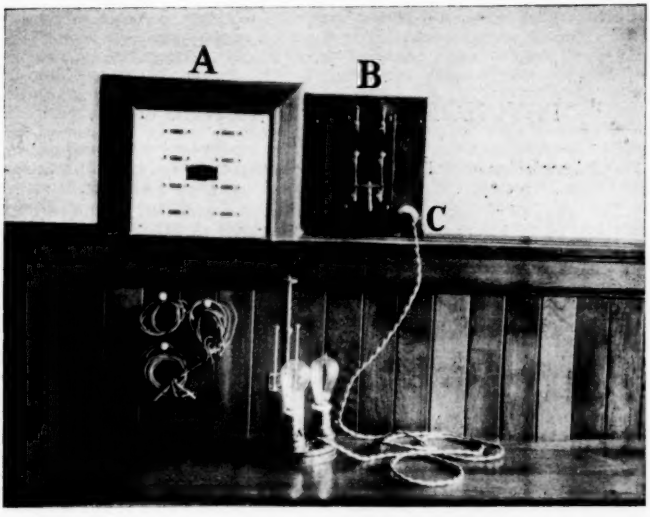


FIG. 2.

In what has been said an effort has been made to show that ten currents, varying in any strength desired from a fraction of a volt to 55 volts, are available at any time in each room of this laboratory. Indeed, we may say not 55 but 110 volts, for by a slight change in the connections with the generator this voltage can be obtained. It is evident that we have here not only the amount of electric current necessary to run the large motor of a workshop and the smaller motors used in color mixing and rotating kymographs, for holding the shutter of a tachistoscope, for the ringing of the signal bells, etc., etc., but a current that is sufficiently constant and regular to give accurate results when employed in the Hipp chronoscope and in time markers.

PSYCHOLOGICAL LITERATURE.

The Dissociation of a Personality, by MORTON PRINCE, M. D. Longmans, Green & Co., New York, 1906. pp. 569. $2.80 net.

The study of abnormal personality has been enriched by the careful analysis of a truly remarkable case. The case of Miss Beauchamp is noteworthy for the treatment to which Dr. Prince subjected the unfoldment of the distorted selves, quite as much as for any spontaneous evolution of the conflicting personalities. For just as the trance-states that flourished under the belief in spiritualism were cultivated by the reception which they met, so will the attitude of the physician towards hysterical dissociation play a part in the maturing of the disintegrated phases of personality. It is through his command of suggestion thus acquired that Dr. Prince was able eventually to discover and restore the original self to a possession of a fairly consistent personality. In this respect the issue is parallel to that which Dr. Sidis was able to establish in the case of Mr. Hanna. Yet the two cases fall in different classes and present quite opposite characteristics. The case of Mr. Hanna belongs to cases of loss of personality through degradation of functions from higher to lower ranges;—what Professor James in the case of Mr. Bourne calls a shrunken, amnesic, abstract of the original self. The case of Miss Beauchamp is one of a warped growth of a personality in the making; and its features accordingly reflect the stress and strain of late adolescence. The unfoldments of the plot centre about the personal emotions, largely infused with moral judgments of *licet* and *non-licet* and with conflicts between ideals and the practical possibilities of their realization. Yet underlying all this must be a more tangible substratum of functional disorder, that induces differences of assimilation and response, of taste and disposition, and deprives each phase of the personality from more than an uncertain participation in the life of the other.

The case is in itself so noteworthy that an outline of its development will be worth reproducing.[1] The subject, "Miss Beauchamp," was about 23 years old when she came under Dr. Prince's care. Her girlhood presented no unusual complications and yet was such as to intensify her natural emotional susceptibilities. There were a few vagaries of action and pronounced eccentricities of character, but nothing that prevented her from being highly regarded by her friends, from whom indeed she was able to conceal the fluctuations of personality that overtook her. At the time of seeking Dr. Prince's care she was a student at college, and of her condition during the next few years, the period of her greatest instability, Dr. Prince writes: "She may change her personality from time to time, often from hour to hour, and with each change her character becomes transformed and her memories altered. In addition to the Real, Original or Normal Self, the Self that was born and which she was intended by nature to be, she may be any one of three different persons. I say three different persons because, although making use of the same body, each, nevertheless, has a distinctly different character; a difference mani-

[1] This is taken in large part from the account given by the present reviewer in a volume on *The Subconscious*, now in press.

fested by different trains of thought, by different views, beliefs, ideals, and temperaments, and by different acquisitions, tastes, habits, experiences, and memories. Each varies in these respects from the other two, and from the original Miss Beauchamp. Two of these personalities have no knowledge of each other or of the third, excepting such information as may be obtained by inference or second-hand, so that in the memory of each of these two there are blanks which correspond to the time when the others are in the flesh. Of a sudden one or the other wakes up to find herself, she knows not where, and ignorant of what she has said or done the moment before. Only one of the three has knowledge of the lives of the others, and this one presents such a bizarre character, so far removed from the others in individuality, that the transformation from one of the other personalities to herself is one of the most striking and dramatic features of the case. The personalities come and go in kaleidoscopic succession, many changes often being made in the course of twenty-four hours. And so it happens that Miss Beauchamp, if I may use the name to designate several distinct people, at one moment says and does and plans and arranges something to which a short time before she most strongly objected, indulges tastes which a moment before would have been abhorrent to her ideals, and undoes or destroys what she had just laboriously planned and arranged."

Of the several variants of Miss B. the most influential took the name of Sally; this personality, in the period of its greatest dominance, may be said to embody the opposition,—the organization of forces that thwarts the supremacy of the real Miss B., and the destruction of which, as the sequel proved, was essential to the restoration of the former. The hostility of Sally to whichever personality was in command may first be illustrated. Miss B., who has an abhorrence of insects and reptiles, finds a box neatly tied, from which, as she opens it, six spiders run out. Sally is subconsciously present to witness the effect of her practical joke, and thus describes the incident: "She screamed when she opened the box, and they ran out all over the room." Special expeditions into the country were made to secure spiders and snakes and toads,—walks that were altogether too taxing for Miss B.'s strength. Sally never felt fatigue; yet naturally their common body showed the effect of such a strain. On one such occasion Sally walked to a suburban town, in which she came to herself as Miss B., utterly stranded and exhausted. To torment Miss B., Sally would unravel the worsted work upon which the former was engaged, and when she permitted its completion, "pulled the whole of it to pieces, and drawing out the yarn wound it round about the furniture, carrying it from picture to picture, back to the different articles of furniture, then round herself many times, then back to the furniture, finally hiding the ends somewhere in the bed. Then Sally, standing in the midst of this perfect tangle of yarn, wakened Miss Beauchamp, who came to herself in the maze. So great was the tangle that she had to cut the yarn to get out." Sally likewise invades the premises of Miss B.'s intentions and coerces her to tell nonsensical lies, and to act upon impulses which the latter entirely repudiates, or is compelled with much embarrassment to explain away. Likewise she chastens by imposing penance, wise or foolish, and generally inconvenient: Discovering that Miss B. has been careless in money matters, Sally takes charge of the purse and hides all the money, leaving only enough in sight for car-fare and the most penurious allowance.

The complexity of this relation was such as to make possible the masquerading of the one personality in the character of the other. The situation will be suggested by the following instance that occurred

when Miss B. was at the hospital, and a European tour was projected: Dr. Prince was suspicious, and found the following state of affairs: "It came to light that Sally had conceived the idea that, as she herself was free from ailments, if she could impersonate Miss Beauchamp she would be considered well, and so escape from the hospital and go to Europe, as had been previously planned. So, when the night nurse looked in upon her, Sally was always found 'asleep;' the day nurse had an equally good report to make, and Miss Beauchamp was soon, in spite of my warnings, discharged 'well.' A few days after this I caught Sally just in time, on the verge of her departure for Europe, and changed her, against her will, to Miss Beauchamp, who was astounded to find herself in my office, her last recollection being her entrance into the hospital ten days previously. It was thus by a lucky chance that Sally did not go to Europe instead of Miss Beauchamp." The measure of control that Sally possesses was well illustrated in her determination at a critical juncture that Miss B. should not be awakened. "Arguments, expostulations, even threats were of no avail. She did not want to be the other one, of whom she spoke in contempt. She simply defied me to wake Miss Beauchamp, and in fact every attempt on my part was unsuccessful. Finally, we compromised; she agreed to allow Miss Beauchamp to be awakened, and I, on my part, agreed (may the ruse be pardoned) that Sally should come again when Miss Beauchamp was *well*." We begin to appreciate why, in view of the marked differences of character which Miss B. and Sally and the personality that emerged later proved to have, Dr. Prince confesses to a temptation to call his volume, "The Saint, the Woman, and the Devil."

The secret of the situation that long remained unrevealed was disentangled by the discovery that the Miss B. who applied to Dr. Prince for relief was, after all, not the original self. This discovery came about by the sudden appearance, as a consequence of hypnotic alteration, of a strange individual who went back to an experience of some six years earlier, and who interpreted the actual situation in terms of that earlier upsetting experience. This traumatic shock, which writers upon hysteria are disposed to consider as a constant factor in the attack, was in this instance of an emotional nature and presumably occasioned the eruption that led to the serious dissociation. Naturally, this awakened self, that in turn was favored by development through suggestion, was ignorant of Miss B.'s experience during the intermediate years. And to abbreviate a story that can only be understood as well as appreciated when biographically illuminated, as Dr. Prince has so ably done, it may be said that a fusion of this older self (and the extinction of the interfering Sally) with certain phases of the later counterpart actually led to a restoration of an individual who was capable of conducting the combined affairs of the Beauchamp household under a consistent regulation.

While the curtailment of this portion of the development necessarily throws the interested student upon the resources of the original, certain further illustrations of the manner of intercourse that came to be established between the several selves may be cited for their decided psychological value. It is theoretically important to note how the one personality acts as a subconscious mentor for the other. Actions that Miss B. performs in moments of distraction will accordingly be recorded in the memory of the subconscious Sally. Sally's powers in this direction are neatly shown in the following incident related in her own words: "'She' yesterday received a letter from a photographer. 'She' had it in her hand while walking down Washington Street, and then put it into 'her' pocket (side pocket of coat) where

'She' kept 'her' watch and money (banknotes). As 'She' walked along 'She' took out the money and tore it into pieces, thinking it was the letter from the photographer. 'She' threw the money into the street as 'She' said to 'herself,' 'I wish they would not write on this bond paper.'" As further proof of Sally's knowledge, she quoted the entire letter verbatim. Sally's undisguised glee in the discomfiture that Miss B. would experience upon discovering the loss of her money, discloses the nature of her animosity. Miss B. was now awakened and acknowledged that she had received such a letter, which, however, she had torn up, but that she had in her pocket two ten-dollar notes. She put her hand in her pocket and with great surprise found only the letter. The instance is the more convincing because Miss B. also professes the faculty, allied to that of "crystal vision," by which with special effort she can penetrate into the regions removed from conscious recall and see as a projected vision what her conscious memory does not reach. By such a process she was astonished to see in the glass-globe herself walking along Washington Street, putting the letter into her pocket and tearing into fragments pieces of green paper.

Not alone were the memory spheres and the dominances of the alternating personalities quite different, but what would be a symbol of an experience to the one was wholly negatived by the other,—a relation familiarly illustrated in the negative hallucinations of hypnosis and the psychic anæsthesias of hysteria. The most remarkable illustration of this contraction of the field of sensation is the following: the Miss B of this incident is the individual known as B IV,[1] the personality that reappeared after six years' sleep. While carelessly fingering a chain upon which some rings were strung, the chain broke and some of the rings were lost. Now the other Miss B (B I) in her uninformed relation to the incident became convinced that all the rings were gone, although Sally, who was well aware of the whole procedure, tried to persuade her otherwise. "'The other two rings are not lost,' said Sally, 'but I can't make her see them. I have put them on her finger, but she won't see them, Dr. Prince; and I have taken her hand and made her take hold of the rings, but she won't feel them. They are round her neck now on a ribbon. I have made her take the rings in her fingers while she is here and I am gone, and I have put them on her finger; but it is no use, she won't see them.'" When Dr. Prince awakened her as B I, he asked her to loosen her collar and showed her the two rings tied on a ribbon about her neck, but though he passed her fingers over them and clicked the two rings together, and held them before her eyes, she was unable to become aware of their existence. He pulled the ribbon hard enough to jerk her head to one side; though she felt the movement, she regarded the method by which it was accomplished as a mystery. This negative hallucination differs from others, that could readily be induced by suggestion only in the fact of its spontaneous origin in a prejudiced conviction. The will to see for this particular range of objects was in abeyance.

It is only natural, when Dr. Prince's treatment favored the development of the restored Miss B (B IV), that Sally, as representative of the thwarting influence, should transfer her animosities to the latter. Between the two there were endless bickerings, in which Sally was obliged to write her derogatory opinions, while B IV could communicate hers by speaking aloud. It is difficult to realize the antagonisms of this divided household. "There were times when IV and Sally would enter into systematic campaigns of hostilities, each determined

[1] The B IV of the narrative is the later Miss Beauchamp, while B I is the individual who applied to Dr. Prince for treatment.

to down the other. Then IV would gird on her armor, and set forth resolute, uncompromising, with blood in her eye, determined to suppress Sally for good and all. She would do her best to destroy everything that her enemy wrote—many a letter to me was destroyed—and to undo everything done. Whatever she discovered Sally was doing, she would reverse. If, for example, she found herself on the way to my house, she would turn about and retrace her steps, or at least would try to do so, for Sally, in her rôle as a subconsciousness, would at once make a dive for the muscular steering gear, there would be a temporary struggle with arms and legs, a sort of aboulia, and then it usually happened that Sally, victorious, would reverse the machinery and head her again for her destination. At night, too, Sally would have another turn. As fast as IV would get into bed, Sally, coming herself, would get up, and then, changing herself back to IV, the latter would find herself to her disgust out of bed again. And so it went on all night; and if IV got off without the bed and furniture being turned upside down she was lucky.

Dr. Prince announces a further volume, in which the more general and theoretical aspects of disturbances of personality will be set forth. The psychologist's interests are naturally centered about such an interpretation, particularly as no other field of experience is able to supply a like insight into the complications of a normal self. It is upon such interference with the normal development of an integrated individual that psychology depends to point the way to the analysis of the normal development. In this light the story of Miss Beauchamp is a peculiarly important contribution. The very detail of its record serves to include and emphasize points of theoretical interest; for such fullness of record and psychological insight into the interpretation of the phenomena presented, Dr. Prince is entitled to the hearty appreciation of the psychological student. JOSEPH JASTROW.

The Secret of the Totem, by ANDREW LANG. Longmans, Green & Co., New York, 1905. pp. x., 215.

This work is one of those lightly written and acutely reasoned anthropological essays, part constructive and part controversial, of which we have now had a round half-dozen from the pen of the gifted author. In some sense, it is the sequel of *Social Origins and Primal Law*, published in 1902 by Messrs. Lang and Atkinson; but it may also lay claim to rank as a novel and independent work. It contains, for the first time fully wrought out, the writer's theory of the origin of totemism. It will, perhaps, be most useful if we here sketch the main outlines of this theory, avoiding both the controversial infusions and the question of prior right on the part of other investigators to this or that feature of the whole case.

Mr. Lang starts out, not from the communal horde, but from a social status in which men were forced by economic conditions to live in small separate groups. He assumes, further, that the members of these groups were animated by the fundamental emotions of love, hate, jealousy, maternal affection, and so forth, so that there must very soon have arisen, within the groups, distinction of persons and certain practical restraints upon amatory intercourse. He inclines to accept Darwin's hypothesis of a single, strong male living with and jealously guarding several 'wives;' from such a 'family' the sons, as they grew up, would naturally be expelled, and would thus be forced to seek their own 'wives' as best they might from other similar families. Such a society would necessarily, for the younger male members, be exogamous in practice.

However this may be, we set out from small, scattered groups of men and women. These groups now, in some way or other—in what

way is quite inessential to the author's theory—obtained animal names. So much is known fact. The theory offered as to the origin of these names is that they were bestowed from without, groups being named by other groups for the sake of practical differentiation. "I cannot prove, of course, that the process of adopting a name from without occurred among prehistoric men, but I have demonstrated that, among all sorts and conditions of men in our experience, the process is a *vera causa*." Mr. Lang, indeed, makes it strikingly plausible, even probable, that the group-sobriquets, although they might be of the kind that we should term nicknames, would be accepted by those upon whom they were bestowed, and also that they would be likely, in a large number of instances, to take the form of animal names.

However *this* may be, then, we have our small scattered groups bearing plant or animal names. It is fact once more, that the origin of the names dropped out of remembrance among those who bore them. Now comes the cardinal point of the theory: the insistence on the importance of the name, on the intensity of the savage belief in the intimate and wonder-working connection of names and things. "If each group woke to the consciousness that it bore the *name* of a plant or animal, and did not know how it came to bear that name [and we must remember that this ignorance is fact, vouched for by the occurrence of mythical explanations of the totem names], no more was needed to establish, in the savage mind, the belief in an essential and valuable connection between the human group Emu and the Emu species of birds, and so on. . . . Totemism begins in the bearing of the name of an object by a human group." And the connection thus established would be, naturally, the connection of the blood bond. "The animal in myth is thus men's ancestor, or brother, or primal ancestral form. This belief would promote kindness to and regard for the animal."

The essentials of Mr. Lang's theory are, therefore, three: a group-name of unknown origin (which we can ourselves account for, plausibly, as a nickname given from the outside); belief in a transcendental connection between all bearers, human and bestial, of the same name; and belief in the blood superstitions. From these three postulates he is able to derive all the totemic creeds and practices, including exogamy. This last, it will be remembered, was (on Darwin's theory) already in existence as a practical matter from the very earliest times. As to the postulates themselves, the second and third are vouched for by all that we know of "the nature of primitive man."

The author now carries his theory into details, discussing the rise of phratries and totem kins, totemic redistribution, and matrimonial classes. A very curious and interesting point is brought out in ch. viii. On the theory presented, there should be in each phratry a totem kin of the phratry name. Now totem kins of phratriac names occur in America; they had not been observed in Australia. If they cannot be found, the new theory (together with certain older ones) falls to the ground. Mr. Lang is able to show, with some natural elation, that the required totem kins do occur in Australia. "I conjectured that phratry names, now meaningless in the speech of the tribes where they appear, might be really identical in meaning with other names now denoting totem animals in the phratries." The conjecture proved to be correct, and the theory thus receives unforeseen confirmation arising out of an apparently fatal objection. The 'method of inquiry' laid down in ch. ii has brought its well-earned result.

On the whole, it seems to the present reviewer that Mr. Lang has put forward the most satisfactory, because the most completely adequate, theory of the origin of totemism that has so far been suggested.

The argument moves—must move—in the field of hypothesis; but there is good anthropological warrant for each step taken. The pragmatic test is fully satisfied: and what can theorist hope for more?

P. E. WINTER.

The Problems of Philosophy, by HARALD HÖFFDING. Translated by Galen M. Fisher, with a preface by William James. The Macmillan Company, New York, 1905. Price $1.50.

This book is not, as perhaps might be expected from the title, an exposition of the problems of philosophy, if such exposition implies simply a discussion of the philosophical views held by other men. It is rather, as James calls it in the preface, the philosophical testament of the author. And as such it contains his *credo*, along with much acute comment upon contemporary philosophical thinking. But while this intimate character of the book gives interest to it, it is not on that account easy. On the contrary, it requires considerable philosophical training to follow the discourse. Consequently, the book is not likely to be useful to young philosophical readers; it is in no sense an introduction to philosophy.

After a short introduction, the four fundamental problems of philosophy (the problem of consciousness, the problem of knowledge, the problem of being, and the problem of values) are, in turn, considered. The philosophical attitude of the author is designated critical monism. This position is described as striving to "maintain the thought of unity without dogmatizing." It seems to arise from the conviction that the quest for unity and connectedness in experience is forever opposed by discontinuity, and that all accounts of reality must necessarily result in an irrational remainder. The common problem of the book is the relation of continuity and discontinuity; it crops out in each of the four chapters. For instance, in the problem of consciousness, the discontinuous is met with in different mental states and in different individual minds. This discontinuity cannot, however, be transcended (as some writers propose) by a reduction of psychology to physiology. Höffding's own attitude in this instance is that, although the discontinuity is apparent, it nevertheless may not be real, since we can never be sure that analysis has gone to the bottom of the matter. And, furthermore, he seems to favor the notion of a potential psychical energy. In the case of the problem of knowledge, there is again a discrepancy between the principles of knowledge and the being which they strive to render. In this instance, there is an irrational remainder in three forms: in the relation of quality and quantity, in the relation of time to the causal concept, and in the relation between subject and object. Likewise in the case of the cosmological and of the ethical problem, continuity seems an impossible achievement. The problems can never be solved; but in the attempt new thought arises.

H. C. STEVENS.

La femme criminelle, par C. GRANIER. Bibliothèque biologique et sociologique de la femme, No. 12, 1906. pp. ix., 468. Price Fr. 4.

This little work on the female criminal is, within its limits, sanely conceived and temperately written. The limits are of two kinds: the size set for the volumes of the Library, and the assignment of volumes on psychology and prostitution to other authors. It is doubtful whether a reviewer has the right to complain of the plan and scope of the work he is reviewing, and libraries of small, uniform volumes are at present in fashion, especially in France. But it must be said that no adequate idea of the female criminal can be obtained without a study of female individual psychology and a study of prostitution, with its conditions and consequences; and, in the writer's judgment,

the reading of three or four small books as against one large one promises no saving of time, while the sectioning of the material may very well lead to artificial boundary lines. An intelligent study of the volume before us is further hindered by the fact that the text is divided up into short, unnamed paragraphs, to which the headings of the analytical table of contents do not correspond; so that it is difficult to decide when one has reached the end of a certain subject, or whether an apparently novel paragraph is merely an excursus within an extended argument. Some of the illustrations are excellent: others are badly reproduced, and of some it may be questioned whether they were not inserted as an after-thought, in order to comply with the Library's demand for an illustrated work.

The first part of the book deals with general criminology: with the statistical differences between male and female criminality, with the influences which favor criminality among women, with the characteristic signs of the female delinquent, and with the question of a criminal type. The second part treats of special criminology, under the headings of maternal, sexual, acquisitive and collective criminality. The third discusses the status of the female criminal before the law, and the attitude of modern society to the question of the punishment of female offenders. The author concludes that "les attributs sexuels irréductibles présentent une différence assez importante pour justifier, en dehors de tout autre argument, l'inégalité de traitement devant la justice pénale."

It may be repeated that the temper of the book is sane and moderate; M. Granier writes from full knowledge of his subject and without bias. He might, perhaps, have avoided to some degree the jerkiness of style referred to above; he can hardly be held responsible for the division of material among the volumes of the Library.

M. W. WISEMAN.

Feeling Psychologically Treated, and Prolegomena to Psychology, by D. J. SNIDER. Sigma Publishing Co., St. Louis, 1905. pp. cxxxii, 402. Price $1.50.

It appears, from the advertisements inserted in this volume, that Dr. Snider is the author of twenty-six books, has a twenty-seventh in preparation, and two others in view. Moreover, the list terminates with an 'over,' which induces the reader to turn the leaf: whereupon he comes upon a blank page, presumably to be filled in the not too distant future.

The reviewer must confess that he was ignorant of all this literary activity until the present work came to his notice. And, if he is to judge from it, he cannot recommend the author as a safe guide in psychological matters. Dr. Snider's position would seem to be that of a panpsychism, strongly tinctured by mysticism; and his method is that of minute logical articulation, such as one finds in the *Erfahrungsseelenlehre* of the eighteenth century. There is evidence that he has read such authorities as Wundt and James, and there are shrewd and suggestive *aperçus* scattered through the text. But the reader who hopes to gain from the book an acquaintance with the affective problems that are now in the forefront of psychological discussion will, most assuredly, come away disappointed.

M. W. WISEMAN.

Leitfaden der physiologischen Psychologie in 15 Vorlesungen, von TH. ZIEHEN. G. Fischer, Jena, 1906. pp. viii., 280. Price, in paper, Mk. 5; bound, Mk. 6.

I have, unfortunately, been able to compare this new edition of Professor Ziehen's Physiological Psychology, not with the sixth edition,

but only with the fifth edition of 1900. The work has grown from 267 to 280 pp.—itself an indication that the changes consist mainly of minor additions to text and notes. I have, indeed, found but one omission, and that of very slight range or importance. The principal additions will be found on pp. 50, chemistry of taste; 51-54, psychology of olfactory sensation; 56, temperature sensations; 75, theories of audition; 76, musical scales; 81 f., psychology of tone; 100, contrast and irradiation; 105, sun and moon illusions; 109, perception of form; 112 ff., adaptation and after-images; 127, melodic feelings; 136, sensation and idea; 139, neurology; 151, teleological value of imagination; 154, 158, memory images; 161, secondary feelings; 197, emotive incoherence; 211 f., attention; 217, method of hits and misses; 238, 243 f., reactions; 250 f., expressive movements; 253, infant psychology; 254, laughter and singing. There is also a new fig. (section through the human cortex) on p. 24. The systematic outlook is wholly unchanged. E. B. T.

Studies in Moro History, Law and Religion, by N. M. Saleeby. Department of the Interior: Ethnological Survey Publications. Manila, 1905, Vol. 4, Pt. 1, pp. 107.

This publication consists of three chapters, dealing respectively with the history of Magindanao, or Mindanao, legendary and recent, with the laws of the Moros, and with the religious orations of the Sulus. Ch. i contains an interesting sketch of the mythology of Mindanao, reminding the reader forcibly of certain tales in the Arabian Nights; translates eight genealogical manuscripts; and ends with a brief history of the island since the advent of Islam. Ch. ii gives an historical account, with translation, of three legal codes: the Mindanao, the principal Sulu, and the new Sulu. It is illustrated by ten half-tone plates of MS. pages. Ch. iii translates the Sulu oration for the feast of Ramadan, and the Sulu Friday oration: it is illustrated by six plates. So far as the layman can judge, the work has been thoroughly and carefully done, and the volume should prove valuable to students of ethnology. H. E. Hotchkiss.

The Nabaloi Dialect, by O. Scheerer. *The Bataks of Palawan*, by E. Y. Miller. Department of the Interior: Ethnological Survey Publications. Manila, 1905, Vol. 2, Parts 2 and 3, pp. 85-199.

The first part of this publication contains a grammar and vocabulary of the dialect of the Ibaloi Igorot, inhabiting a portion of the district of Benguet in northern Luzon: there is added an account of a Spanish expedition to Benguet in the year 1829. The paper gives some interesting notes, with musical transcription, of Ibaloi songs, and among the 22 half-tone plates (from photographs by D. C. Worcester) are representations of musical instruments. The second part describes the primitive people known as Bataks, found in the mountains of the interior of Palawan, about 40 miles north of Puerto Princesa. The paper is illustrated by 6 plates from photographs by the author.
H. E. Hotchkiss.

Laboratoire de physiologie de l'université de Turin: Travaux des années 1904-1905 publiés sous la direction de A. Mosso. Extrait des Archives italiennes de biologie, 1905. Vols. 41-43. pp. vii., 337.

This volume contains twenty-six reprinted physiological papers from the Turin laboratory, eighteen of them bearing the name of the director, alone or in collaboration with MM. G. Marro and G. Galeotti. The remaining articles are by MM. C. Foà, G. Galeotti, A. Aggazzotti, A. Herlitzka and M. Ponzo. The greater part of the volume is devoted to the phenomena of respiration and circulation at high altitudes;

there is but one paper dealing with the organs of sense, that of M. Ponzo 'Sur la présence de bourgeons gustatifs dans quelques parties de l'arrière-bouche et dans la partie nasale du pharynx du fœtus humain.'

P. E. WINTER.

Germs of Mind in Plants, by R. H. FRANCÉ. Translated by A. M. Simons. Charles S. Kerr and Co., Chicago, 1905. pp. 151.

The author first points us to the naïve student of nature and the living, perceiving plants of fable and tradition. He gives as proof of the fact that we have become divorced from nature a description of the lifeless systematic Linnean botany. Though there has been for some time a reaction against this, few botanists yet endow plants with sensation. Plants make all the movements their life demands as is shown by the insect eating sun-dew and the hundreds of species of carnivorous plants. Nyctitropism, hygrotropism, geotropism and heliotropism in plants all show this movement. Its *tempo* is much slower than in animals and it often takes patience to observe it. Plants sense odors, flavors, light, vibration, etc., and perhaps many qualities to which we are insensible. Haberlandt has made out several sense organs. Plants give us the best example of reaction to gravity. The starch grains are compared with the statocysts of crabs. The reactions of plants when injured points to the existence of temporary nerve-like elements and Němec has found such in the root of the onion and others. Transmission is also cared for by the protoplasmic tubes.

Sensations must be utilized; is there perception and a soul? The poetry of flowers gives a better conception of the real essence of nature than the exact *veri botanici*. The author's notion of sensation is seen in the statement "All my involuntary movements are released by sensations." Plants become accustomed to different kinds of stimuli. The author is not quite prepared to say that plants feel pain and have a soul, but neither is he satisfied with the position taken by neuropsychology. It does not explain by assigning all to irritability of living substance. There is purposefulness which is not mere teleology. In plants we get reactions which are other than mechanical. The final statement is that plant life is like that of animals and our own. Their sense life is primitive but in it we see a beginning of animal and human mind. Each of these generalizations is illustrated with many concrete examples and drawings. It is the interpretation given to these which one feels inclined to call in question. Various references to the philosophic and poetic make the book, at any rate, very entertaining.

JAMES P. PORTER.

The Changing Order, by OSCAR LOVELL TRIGGS. Chas. H. Kerr & Co., Chicago, 1906.

"The Changing Order" is the change from aristocracy to democracy. Democracy is not a matter of politics only; but is a new spirit of life which signifies the "uprise of the people, the masses." The author starts out to trace the effects of democracy on art, education, industry, and religion; but he does not accomplish this purpose, for he does not distinguish the products of democracy itself from the products of individuals in an aristocratic society who may yet have popular sympathies. Tolstoi, for example, is not a product of democracy, but a reaction from aristocracy. The book is suggestive, however, in tracing various expressions of democratic sentiment. The volume consists of somewhat disconnected essays, several of which have been printed before.

F. A. BUSHEE.

BOOK NOTES.

[Notice of books and articles in this section does not preclude fuller reviews later.]

Experimental Psychology. A Manual of Laboratory Practice. By EDWARD BRADFORD TITCHENER. Vol. 2, Quantitative Experiments. Part 2, Instructor's Manual. The Macmillan Co., New York, 1905. pp. 453.

At last, we have the long-awaited second volume of the author's quantitative experiments. The motto is from Delbœuf to the effect that any phenomena, physical or moral, not translated in numbers, always leaves on the mind the effect of mysticism. The introduction describes the rise and progress of quantitative psychology from Weber. The first chapter, on preliminary experiments, is devoted to tones, pressure and Weber's law. The second, on metric methods, discusses the law of error and the method of limits historically and critically. Other experiments are classified as falling under the limens of continuous change; then Fechner's method of average errors; then that of equivalents; then that of equal sense distances; the method of constant R and of R differences, of right and wrong cases, most of which are treated historically as well as experimentally. The reaction experiments have a chapter by themselves. This topic opens with a discussion of electrical units and measurements and a description of the technique of simple reactions. The three types of the latter are then discussed and this is followed by an experiment involving compound reactions, discrimination, cognition, choice and association. Special final chapters are given to the estimation of time and to some typical experiments showing the range of quantitative psychology. Fuller notice will follow.

A Plethysmographic Study of the Vascular Conditions during Hypnotic Sleep. Dissertation submitted to the Board of University Studies of the Johns Hopkins University for the Degree of Doctor of Philosophy, 1900, by ELISHA CHISHOLM WALDEN. pp. 124-161.

On suggesting hypnotism the arm is slightly constricted and the plethysmographic trace mounts, but falls when the act of suggestion ends. Then for some hours it steadily rises as it does until the end of the hypnotic sleep. On waking there is sudden rise in the curve. The pulse rate is slower during hypnotic sleep than before or after; so is the respiration. The rectal temperature falls slightly. The surface temperature of the arms is higher. "It is difficult to draw any general conclusions as to the bearing of these facts as to the theories of the cause of hypnotic sleep."

Die Lichtsinnesorgane der Laubblätter von DR. G. HABERLANDT. Wilhelm Engelmann, Leipzig, 1905. pp. 142.

It appears that we have not yet sufficiently defined the meaning of the word eye. If it means a local organ for the sense of light, or the perception of light and dark, the leaves of plants have eyes, although, of course, they do not have them if the term is confined to perceptions of form. Both the cuts and the experiments of the author certainly show remarkable things in panphotometric leaves. The author has made many new experiments on the epidermis of leaves and has

many cuts, which certainly suggest that there may be some perception of light in the cryptogams, and heliotropism, and afford many interesting analogies.

Geschmack und Geruch. Physiologische Untersuchungen über den Geschmackssinn, von WILHELM STENBERG. Julius Springer, Berlin, 1906. pp. 149.

The writer has here summed up in a concise and admirable way the results of the various experiments upon taste and smell, and added to these some new results and an important new and more precise method. According to Toulouse and Vaschide, Influence de l'age et du sexe sur l'ordorat. Soc. de Biol. 10. 6. 99., sensitiveness to smell develops up to the sixth year and then declines with years. The sense of smell is earlier and more fully developed in men than in women and there appear to be hereditary differences.

The Color Sensitivity of the Peripheral Retina, by JOHN WALLACE BAIRD. Published by the Carnegie Institution of Washington, 1905. pp. 80.

The writer concludes that in moving across the retina the images of colored objects pass through regular tones, the position and extent of the color zones everywhere depending upon the momentary degree of retinal adaptation, brightness, etc. Of all possible colors only four undergo no change in indirect vision—a purple-red, a yellow, a blue-green, and a blue. A color stimulus near the periphery of the retina rapidly fades out. The results are in accordance with the Hering and Franklin theories of vision and cannot be reconciled with any other.

Der moderne Spuk- und Geisterglaube. Eine Kritik und Erklärung der spiritischen Phänomene, von RICHARD HENNIG. Ernst Schultze, Hamburg, 1906. pp. 367.

The author publishes here the second part of a work entitled Wunder und Wissenschaft, with a preface by Professor Max Dessoir. First of all, he candidly presents the sources of error in proving spiritual agencies among which he finds to be the tendency to personify unknown impressions and to imagine perceptions and memories. He recognizes, also, frequently conscious fraud. Passing next to the secrets of trance he seeks to explain what has been called diabolical possession, inspiration, stigmatism, belief in the werwolf and possession by mediums, speaking in a foreign language, Helene Smith and her four chief spirits. In the third part he discusses automatic table movements, psychic activities, raps, haunts, materialization, spirit photography, the astral body, doubles, fourth dimension, scientific authority, and finally the relations of spiritism to psychology and pathology. We must certainly assign to this work a higher and more scientific and generally satisfactory position than we could ascribe to the first part. It is a work which every one at all interested in this subject should certainly know.

The Socialization of Humanity. An Analysis and Synthesis of the Phenomena of Nature, Life, Mind and Society through the Law of Repetition. A System of Monistic Philosophy. By CHARLES KENDALL FRANKLIN. Chas. H. Kerr & Co., Chicago, 1904. pp. 481.

The author first analyzes nature, life, mind and society to get a realistic conception of things. He finds very basal, underlying all of these, the law of repetition. He then discusses the origin of life, the physics of the senses and the intellect, the chemistry of the senses, emotions and will, animal mechanics, realism and idealism, natural-

ism versus super-naturalism, the expenditure of energy controlled by the mind as a fourth law of motion, control by moral sense a fifth law of motion, and controlled by the social sense a sixth law. He then discusses the supreme law of ethics, religion, the social organism, its dynamics, the hypothesis of God and immortality, the theological social sense, the aspects of scientific morality; finally synthesis of nature, life, mind and society, what the socialization of humanity will accomplish. The final chapters are devoted to forestalling criticism and to applications and conclusions.

Twenty-Third Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1901-1902. J. W. POWELL, Director. Government Printing Office, Washington, 1904. pp. 634.

Mrs. M. C. Stevenson, widow of the well known American anthropologist, here summarizes the result of twenty-five years of investigations of archæologists and ethnologists, which have centered on Arizona and New Mexico. These regions were once densely populated, then desolated, and since held in precarious tenure by the remnants of a dwindling race. The older ruins are in the valleys and here the people lived in prosperity until, by their powerful foes, they were forced to take refuge in caves and cliffs. Many of the stone structures here are centuries old. The author takes up the mythology, worship, rituals, calendar, major and minor festivals, history, arts, customs, games, physical traits, medical practice, witchcraft, esoteric fraternities, and gives us 139 large cuts, many of them colored and full-page, and 34 figures. Her work is largely a labor of love, and of all the precious 22 volumes of the Bureau of American Ethnology, this will always remain one of the most general interest and value.

The Native Tribes of South-East Australia, by A. W. HOWITT. Macmillan & Co., Ltd., London, 1904. pp. 819.

The writer first discusses the origin of the aborigines of Tasmania and Australia, believing it to be the same. Successive chapters then treat of tribal and social organization, relationship terms, marriage rules, tribal government, medicine men, magic beliefs, burial practices, initiation ceremonies of the eastern and western type, messengers and message sticks, barter and trade centres, gesture language. The work is apparently very scholarly, showing wide knowledge of the literature upon the subject, and, what is, of course, far better, bearing everywhere the marks of careful personal investigation.

The Journal of Abnormal Psychology. Edited by MORTON PRINCE, M. D. and others. Bi-monthly, $3.00 per year.

The editors of the *American Journal of Psychology* extend a hearty welcome to their colleagues of the new *Journal of Abnormal Psychology*, the first number of which has just appeared with the imprint of the Old Corner Bookstore, Boston. The field which the new *Journal* represents is perhaps just now the most promising, both theoretically and practically, in the whole range of psychological science, and the character of the editors (Morton, Prince Münsterberg, Putnam, Hoch, Sidis, Dana, and Adolf Meyer) guarantees the quality of the new venture.

The first number contains articles on Impulsions by Pierre Janet, Hypnosis by V. Bechterew, Hysteria by James J. Putnam, and Sudden Conversions by Morton Prince—54 pages in all. A department of current literature will be added in subsequent numbers, to which many able hands will contribute.